CEDAR LAKE ENHANCEMENT ASSOCIATION, INC.
Cedar Lake, Indiana

CEDAR LAKE DREDGE FEASIBILITY STUDY

HARZA Consulting Engineers and Scientists

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DRAFT

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Prepared for

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Cedar Lake, Indiana

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ACRONYMS

ADDAMS	Automated Dredging and Disposal Alternatives Management System
ARDL	Applied Research and Development Laboratory, Inc.
CDF	Confined Disposal Facility
CLEA	Cedar Lake Enhancement Association, Inc.
CVM	Contingent Valuation Method
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
LARE	Lake and River Enhancement
MHI	Median Household Income
MSL	Mean Sea Level
NED	National Economic Development
NIPSC	Northern Indiana Public Service Company
PCBs	Polychlorinated Biphenyls
SBA	State Budget Agency
SRF	State Revolving Loan Fund
TKN	Total Kjeldhal Nitrogen
TOC	Total Organic Carbon
USACE	United States Corps of Engineers
USEPA	United States Environmental Protection Agency
WQC	Water Quality Certification

1.0 EXECUTIVE SUMMARY

Past investigators have pointed out the significance of internal sources of phosphorus in the lake's nutrient budget: as much as 84% of phosphorus loadings to the water come from the sediment. Hence, this evaluation was commissioned to examine, in detail, the costs and benefits of remediating this source of nutrients. The study includes the following elements:

- Sediment Quality Survey
- Spoil Disposal Site Selection
- Preliminary Design
- Identification of Potential Funding Sources
- Potential Economic Benefits of Dredging

Our examination of sediment quality confirmed the presence of very nutrient rich sediments in the lake. Total phosphorus concentrations in the sediment average nearly 500 mg/kg and we measured concentrations as high as 1,060 mg/kg, or 0.1%. Ammonia nitrogen in sediment averages 326 mg/kg (maximum = 797 mg/kg) and organic nitrogen as high as 8,500 mg/kg. These nutrient concentrations are extremely high, and support the position of previous investigators that internal sources of phosphorus are quite significant in this system.

Dredging the lake will address this source of loading and produce water quality benefits commensurate with the amount of phosphorus removed from the system. Harza evaluated the technical, environmental and economic costs and benefits of dredging in this study. For dredging projects of this magnitude, hydraulic dredges, typically using cutterheads, are used, with the spoil pumped to an upland confined disposal facility (CDF).

We analyzed two dredge projects in detail. Case I proposes the removal or 670,000 cubic yards of sediment from Cedar Lake. This is the estimated volume of sediment removal that would be required to dredge the upper seven or eight inches of the whole lake. Case II involved the removal of 130,000 cubic yards of sediment. This is the estimated volume of sediment removal that would be required to dredge the same depth of sediment from the areas with the highest nutrient concentrations (about 120 acres).

Six potential CDF sites were identified from a review of available maps and site visits. Site selection criteria included the proximity of the site to the lake, proximity to an outlet site (stream, lake, river, or wetland), elevation (head) difference, amount of sediment to be dredged, natural topography, amount of potentially available land, presence of environmentally sensitive areas (forests, wetlands), construction access, and construction concerns (i.e, power lines, railroad tracks, tile drains, etc.). All site were deemed to be suitable for CDFs. We recommend that the closest sites be selected if landowner consent can be obtained, as the closest sites will have the lowest project costs. Site A (Figure 12) was selected for use in development of the cost estimates. Site A has a convenient drainage swale leading to the proposed constructed wetland on Sleepy Hollow Ditch; the wetland could provide additional treatment of the CDF effluent before returning to Cedar Lake. Upon project completion, the CDF would be regraded, reseeded, and if necessary, soil amendments added to adjust pH. The property could then be reused for agricultural activities, or the spoil sold as topsoil.

Table 1-1 summarizes critical information about the two dredging cases evaluated. Costs for project development were based upon:

- Use of Site A for the CDF
- Two-year leasing of land for the CDF
- Dredging equipment and schedules consistent with Harza's experience and industry standards

Table 1-1
DREDGING PROJECT COMPARISON

	Case I	**Case II**
Sediment Removed	670,000 yd^3	130,000 yd^3
CDF Size	80 acres	35 acres
Effluent Solids Concentration	9 mg/L	27 mg/L
Construction Cost	$5.7 million	$2 million
Internal P Loading Reduction	80%	50%
Likely Chlorophyll a Reduction	38%	24%

All government subsidies available for financing a dredging effort will likely require a local cost-share commitment. As such, we encourage the lake association to continue its efforts in this regard. The two most promising sources of financing assistance are the State Revolving Loan Fund (SRF) and the Build Indiana Fund. The SRF, created by the Clean Water Act Amendments of 1987, has financed many municipal wastewater collection and treatment projects in the State. Currently, the Indiana Department of Environmental Management (IDEM) is revising its SRF policy and, in about two years, when the policy goes into effect, nonpoint source projects will be eligible for SRF financing. Interest rates available to a community are based on the median household income (MHI) of the service area. The lake association, however, may not be eligible to borrow from this fund. An entity with a demonstrated ability to repay the loan, such as the Town, will need to be the local sponsor. The Build Indiana Fund is currently financing $1.5 million for dredging Lake Shipshewana in Lagrange County. The Indiana Department of Natural

Resources' (IDNR) Lake and River Enhancement (LARE) Program is overseeing that project. This sort of financing requires a line item appropriation by the legislature.

In the fiscal year 1997-1998, IDEM's Section 319 Program funded grants of $2.3 million for 14 water quality restoration projects. In the future, specific watersheds will be targeted for 319 funding and given preferential treatment. Cedar Lake is in the Kankakee River Watershed and is currently not a targeted watershed by IDEM. Under the 319 Program, a 25% local cost-share is required and an upper limit of $112,500 is enforced. Hence, the 319 program offers limited opportunities for projects of this magnitude.

Dredging Cedar Lake will produce tangible and intangible socioeconomic benefits. Typically, monetizing environmental benefits requires substantial local and regional data on the use of, and willingness to pay for, these benefits. In general, these data are not available for Cedar Lake, Lake County, or northwest Indiana, but Chapter 5 identifies these benefits and quantified them to the extent possible within the constraints of data availability and budgetary resources. A water resource project's economic benefits include direct net and secondary (or regional) economic values: measures of economic value that are conventionally applied within standard water resource evaluations. Direct value refers to the economic benefits derived from primary economic activities or sectors, such as a reliable water supply for municipal uses or the value individuals place on recreational opportunities. Direct net value represents the net benefits derived from primary economic activities, over and above the costs of providing such activities (or the avoided costs). Secondary or regional economic benefits refer to measures of local income or employment, or expenditures generated by the direct economic activities. Secondary or regional economic benefits (or values) are a distinct category of economic activity are separate from direct benefits when considering contributions to national economic development (NED accounting) or activity.

Estimating recreation benefits requires site specific data on demands and competing facilities, However, based upon our experience elsewhere, an additional 500 sport-effort fishing days could be valued at about $30,000; an additional 500 boat-use days could be about $12,500; and an additional 500 day-use days could be about $15,000.

An ever greater economic benefit would materialize for lakefront property owners. Lakefront properties command higher prices than comparable non-lake-front properties within the Cedar Lake area. The lakefront properties (and lake view properties) appear to retain asking prices (not market clearing prices) about 25-40% greater than the other properties (many lake-front properties exceeding $100,000 in value). Realtors also indicate that the demand for lake-front properties is very high, with potential home owners and developers making regular inquiries. Realtors we consulted anticipate that any changes to lake water quality would likely enhance the demand for lakefront (and view) properties, thus increasing land values. Conducting property inventories is beyond the scope of the analysis presented here, so accurate estimates of potential changes to total land and property values are not readily available. But it can be assumed that relatively small changes to property values could represent several hundred thousands, or millions, of dollars of increased value. For example, if 100 properties valued at $50,000 each increased in value by 10%, the total value increase would be $500,000.

2.0 INTRODUCTION

2.1 Background

In 1998, the Cedar Lake Enhancement Association, Inc. (CLEA) commissioned a feasibility study of dredging Cedar Lake in order to enhance its water quality and socioeconomic values. The rational for this evaluation involved several factors unique to Cedar Lake: historic sewage overflows to the lake, the lake's low flushing rate and long recovery time, high sedimentation rates, and shallow depths. The majority of the lake's nutrient loading is internally generated and watershed management measures alone will not meet water quality restoration goals for the lake.

2.2 Objectives

The lakeside residents and users of Cedar Lake have long expressed concern due to deteriorating water quality. In 1978 the Indiana State Legislature appropriated funds to determine the feasibility of restoring Cedar Lake (Echelberger, *et. al.*, 1979). Since 1978, a series of three reports have addressed water quality concerns and possible solutions at Cedar Lake. All of these studies pointed out the significance of internal sources of phosphorus in the annual algae blooms. This evaluation is the first to examine, in detail, the costs and benefits of remediating this source of nutrients. The current study includes the following elements:

- Sediment Quality Survey
- Spoil Disposal Site Selection
- Preliminary Design
- Identification of Potential Funding Sources
- Potential Economic Benefits of Dredging

2.3 Acknowledgments

Harza would like to extend appreciation for the assistance given to the study team by the CLEA. Particularly valuable was the assistance and enthusiasm of the CLEA's Board and its President, Mr. Robert Gross, Jr.

Several individuals and agencies provided important and invaluable data and input for this study: the IDNR's Lake and River Enhancement (LARE) Office, Division of Fish and Wildlife, Division of Water; the Indiana Department of Environmental Management; the Lake County Soil Conservation Service; the Environmental Systems Application Center at the School of Public and Environmental Affairs, Indiana University; the United States Army Corps of Engineers; the Hanover Township Assessor's Office, and the Cedar Lake Chamber of Commerce.

This report was written by Mr. Douglas Mulvey, the Project Engineer for this study. Also contributing were Mr. David Pott (Project Manager), Mr. Edward Belmonte (Environmental Scientist), Whoo Hee Choi (Hydraulic Engineer), and Mr. Daryll Olsen (Environmental Economist), and Mr. Wili Tolentino (Drafter).

3.0 DESCRIPTION OF THE STUDY AREA

3.1 Location

Cedar Lake is located in the west central section of Lake County in northwestern Indiana (Figure 1). Cedar Lake is located approximately 35 miles southwest of Chicago and is approximately 1.5 miles east of U.S. 41.

3.2 Lake Physical Characteristics

Much of the available information on Cedar Lake has been gathered and published by other authors. Principal sources of information include Echelberger, Jr., *et al.* (1979), Echelberger, Jr., *et al.* (1984), and Jones and Marnatti (1991).

Cedar Lake is a 781-acre kettle lake with a maximum depth of 16 feet and a mean depth of 8.8 feet (Jones and Marnatti, 1991). A dam and gaging station are located at the outlet of the lake, Cedar Creek. The structure maintains a lake level of about 693 feet mean sea level (MSL), providing for a mean storage volume of approximately 6,875 acre-feet. The mean hydraulic retention time is 1.25 years. This lengthy hydraulic retention time has limnological significance for this lake enhancement effort:

- The lake has a high sediment trapping efficiency
- This is a high phosphorus settling rate
- Recovery time will also be lengthy

The Cedar Lake shoreline is heavily developed with seasonal and year-round residences. The north and south ends of the lake have adjacent wetlands ranging in size up to 400 acres. Boating, fishing, water skiing, and swimming are popular activities on the lake (Jones and Marnatti, 1991).

3.3 Sediment Characteristics

Harza collected and analyzed 22 sediment samples and water quality parameters in July 1998 (Figures 2 and 3). Sediment samples were collected with a weighted hollow-stem sediment corer. Samples for analysis were collected in plastic sleeves and transferred to a stainless steel bowl where they were homogenized, classified, and transferred to glass jars. These samples were stored on ice for shipment to Applied Research Development Laboratory (ARDL), Mt. Vernon, Illinois, for analysis. At sediment sampling locations, water quality parameters were also monitored. These included water temperature, dissolved oxygen, conductivity, pH, water depth, and Secchi depth. All sediment samples were analyzed for total Kjeldahl nitrogen (TKN), ammonia nitrogen, total phosphorus, total solids, total organic carbon (TOC), particle size analysis, and hydrometer. Ten of the samples were analyzed for polychlorinated biphenyls (PCBs). Laboratory results and boring logs are provided in Appendix 1, a summary of which appear in Table 3-1.

Table 3-1
SUMMARY OF FIELD AND LABORATORY RESULTS FOR SEDIMENT SAMPLING

Sample Location	SS-01	SS-02	SS-03	SS-04	SS-05	SS-06	SS-07	SS-08
Classification	Sandy silt (ML)	Sandy silt (ML)	Silty sand (SM)	Silty sand (SM)	Silty sand (ML) with a few clay	Silty sand (SM)	Sandy silt (ML)	Silty sand (SM)
% fines (< # 200 sieve)	53	54	41	37	47	37	53	45
PCBs (μg/Kg)	NA	NA	ND	NA	ND	NA	ND	NA
Kjeldahl Nitrogen (mg/Kg)	2790	7340	8580	7970	412	7070	7900	5650
Ammonia Nitrogen (mg/Kg)	46.2	601	298	385	21.9	686	520	693
Total Phosphorus (mg/Kg)	308	666	464	536	221	456	947	656
Total Solids (%)	40.3	24.4	21.1	21.1	79.1	20.9	24.3	21
Total Organic Carbon (mg/Kg)	96600	59500	109000	81700	23300	90300	68800	86800
Water Temperature (°C)	27	28	27	27	27	27	27	27
Air Temperature (°C)	28	28	29	29	28	27	28	27
Dissolved Oxygen (mg/L)	7.8 @ 2'	7.7 @ 3'	7.8 @ 3'	6.7 @ 3'	8.4 @ 3'	6.25 @ 4' 6.0 @ 7'	6.4 @ 4' 5.96 @ 7'	7.2 @ 4' 6.5 @ 7'
Conductivity (μMHOS)	312	315	312	310	312	310	308	300
pH	9.17	9.01	9.1	9.19	9.28	9.05	9.15	9.16
Water Depth (ft)	9.3	14	11	12	5	14	13.5	13.5
Secchi Depth (ft)	0.95	1	0.85	0.9	0.85	0.95	0.85	0.95

Sample Location	SS-08	SS-09	SS-10	SS-11	SS-12	SS-13	SS-14
Classification	Silty sand (SM)	Sandy silt (ML)	Silty sand (SM)	Poorly graded sand (SP) with trace silt	Sandy silt (MH) with trace clay	Sandy silt (ML)	Silty sand (SM)
% fines (< # 200 sieve)	45	52	44	3	62	60	34

Sample Location	SS-08	SS-09	SS-10	SS-11	SS-12	SS-13	SS-14
PCBs (μg/Kg)	NA	ND	NA	ND	NA	NA	ND
Kjeldahl Nitrogen (mg/Kg)	5650	7660	7320	151	8060	6400	8020
Ammonia Nitrogen (mg/Kg)	693	237	797	4.4	404	675	202
Total Phosphorus (mg/Kg)	656	395	725	72.6	588	581	524
Total Solids (%)	21	19.2	21	80.2	18	21.3	20.2
Total Organic Carbon (mg/Kg)	86800	132000	99400	1090	132000	94200	86000
Water Temperature (°C)	27	27	27	27	29	27.5	27
Air Temperature (°C)	27	28	27	28	28	28	27
Dissolved Oxygen (mg/L)	7.2 @ 4' 6.5 @ 7'	8.1 @ 4'	7.35 @ 4' 5.10 @ 7'	6.85 @ 4'	8.6 @ 4'	8.8 @ 4'	7.50 @ 4'
Conductivity (μMHOS)	300	308	308	303	285	300	302
pH	9.16	9.38	9.53	9.18	9.51	9.31	9.41
Water Depth (ft)	13.5	10	14.5	6.7	9.5	14	13.5
Secchi Depth (ft)	0.95	1	1.1	1	1.05	1	0.95

Sample Location	SS-15	SS-16	SS-17	SS-18	SS-19	SS-20	SS-21	SS-22
Classification	Clayey silt (MH) with a little sand	Silty sand (SM)	Poorly graded sand with silt (SP-SM)	Silty sand (SM)	Sandy silt (ML)	Sandy silt (MH) with a little clay	Silt with sand (ML)	Sandy silt (ML)
% fines (< # 200 sieve)	88	47	12	38	52	60	75	66
PCBs (μg/Kg)	ND	NA	ND	NA	NA	ND	NA	ND
Kjeldahl Nitrogen (mg/Kg)	6140	6930	1400	5900	6480	324	6370	3400
Ammonia Nitrogen (mg/Kg)	150	558	43.6	239	207	30.8	238	129
Total Phosphorus (mg/Kg)	268	539	370	1060	468	250	411	363
Total Solids (%)	23.8	23.8	61.7	21.1	22.4	78.5	21.8	30.4

Sample Location	SS-15	SS-16	SS-17	SS-18	SS-19	SS-20	SS-21	SS-22
Total Organic Carbon (mg/Kg)	119000	98100	16000	93400	107000	28700	106000	64800
Water Temperature (°C)	28	28	28	26	26.5	26	26	26
Air Temperature (°C)	25	26	26	27	26	23	24	25
Dissolved Oxygen (mg/L)	9.5 @ 3'	8.5 @ 4'	8.60 @ 3'	6.60 @ 5'	7.5 @ 3'	6.55 @ 3'	7.25 @ 4'	7.75 @ 3'
Conductivity (μMHOS)	300	300	305	298	302	290	295	290
pH	9.27	9.47	9.7	9.26	9.07	9.21	9.22	9.41
Water Depth (ft)	9.5	13	6.5	10.5	9	7	9.5	7.5
Secchi Depth (ft)	1.05	1	1.05	0.85	0.9	0.9	0.9	0.95

Six near shore sediment samples (Figure 3) were also collected in July 1998 for *Escherichia coli* analysis. The samples were collected with a stainless steel hand auger and transferred to Whirlpacks™ and stored on ice until transferred to the Lake County Health Department for analysis. Results are presented in Table 3-2.

Table 3-2
SUMMARY OF LABORATORY RESULTS FOR SEDIMENT SAMPLING FOR *E. COLI*

Sample Identification	*E. coli* Count
SEC-01	>30,000
SEC-02	<1
SEC-03	<1
SEC-04	<1
SEC-05	<1
SEC-06	<1

Figures 3 through 8 present isopleth maps of sediment concentrations of total phosphorus, TKN, ammonia nitrogen, TOC, and percent fines, respectively. Results from these analyses suggest that the lake sediments are enriched with nitrogen and phosphorus. Samples also contain relatively high percentages of organic matter, which may reflect the lake's eutrophy and high level of autochthonous productivity. This is most evident in the deeper parts of the lake (> 5 ft). *Escherichia coli* results suggest that the inlet on the north end of the lake, which drains a small watershed, poses some concern to swimmers.

Regression analyses (Appendix 2) were performed on all 22 sets of collected data to better assess trends evident in the data. Table 3-3 provides the coefficients of determination, R^2, for these regressions. R^2 is that proportion of the total variability in the dependent variable that is accounted for by the regression equation. A $R^2=1$ indicates that the equation accounts for all variability and a $R^2=0$ indicates that the equation explains none of the variability. A "statistically significant equation" is one with quantified degrees of confidence; Table 3-3 identifies data pairs that have a 5% ($P<0.05$) or 1% ($P<0.01$) chance of concluding significance when non actually exists. For example, TOC in Cedar Lake sediment can predict 63% of the variability in TKN more than 99% of the time ($P<0.01$)

Generally as water depth increased, sediment TKN, sediment ammonia nitrogen, TOC, and sediment phosphorus concentrations increased. Several statistically significant correlations exist. Classic sediment science would predict that pollutants would preferentially absorb to finer sediment particles; this premise does not hold up here. Percent fines, as represented by the percentage of a sample that passes through a No. 200 sieve (< 0.074 mm), has a significant correlation with TOC ($R^2 = 0.301$; $P<0.01$), but not with any nitrogen or phosphorus measurement. Perhaps the most important finding is the statistical significance of the correlation of sediment nutrients with water depth. Water depth at the sample location positively correlates with organic content ($R^2 = 0.22$, P,0.05), total phosphorus ($R^2= 0.432$, $P<0.01$), TKN ($R^2= 0.61$, $P<0.01$) and ammonia nitrogen ($R^2= 0.79$, $P<0.01$). Other significant correlations between sediment variables are included in Table 3-3.

Table 3-3
SEDIMENT PARAMETER LINEAR COEFFICIENTS OF DETERMINATION, R^2
(N=22)

	% fines	Organic Carbon	Phosphorus	Organic Nitrogen	Ammonia
Organic Carbon	0.33**	-	-	-	-
Phosphorus	0.003	0.125	-	-	-
Organic Nitrogen	0.085	0.63**	0.38**	-	-
Ammonia	0.11	0.15	0.38**	0.42**	-
Water Depth	0.005	0.22*	0.43**	0.61**	0.79**

% fines = % passing No. 200 sieve (< 0.074mm)
* = Correlation significant at or beyond 0.05 level
** = Correlation significant at or beyond 0.01 level

Analyses for sediment toxic chemicals, except for polychlorinated biphenyls (PCBs), were not performed.

PCBs were tested because of the fish consumption advisory in place. Indiana Department of Environmental Management (IDEM) has advised that catfish from Cedar Lake be eaten only in limited quantities due to PCB contamination. This advisory is based upon 1987 testing of carp and channel catfish, as well as sediment. IDEM's complete analysis of two sediment samples (one each from the north and south basins), presented in Appendix 3, found limited presence of heptachlor in the north basin sediment sample, and none in the south basin. All of our testing of ten sediment samples for PCBs were below the method detection limit. Based upon these two data sources, it does not appear that the sediment to be removed from Cedar Lake is a hazardous material that would require special handling, storage, or treatment precautions prior to disposal.

4.0 DREDGING FEASIBILITY ANALYSIS

Dredging is performed by either mechanical or hydraulic means. Mechanical dredging generally involves using clamshells to remove materials and place them in trucks or floating barges. Other means of mechanical dredging include using earthmoving equipment (i.e. scrappers) after dewatering the lake. This is generally only feasible when lake water volumes are small and the lake has a low-level outlet works. Mechanical dredging operations entrap some water during dredging, but tend to have higher solids concentrations than hydraulic dredging operations, usually in the range of 200 to 500 g/L. Environmental and water quality impacts resulting from mechanical dredging are usually great as sediment and nutrients are resuspended in the overlying water column.

Hydraulic dredging is performed with cutter heads attached to large pipes (~12 inches) and the resulting water/sediment slurry is vacuumed and pumped to a confined disposal facility (CDF) retention facility. Hydraulic dredging operations add this water to facilitate pipeline transport; hydraulically pumped dredged material slurries typically contain sediment concentrations between 50 and 200 g/L depending upon sediment and dredge characteristics. Properly performed, hydraulic dredging generally contributes fewer environmental and water quality impacts when compared with mechanical dredging. Hydraulic dredging is usually more cost effective for large dredging projects (>100,000 cubic yards) and will be more economical for Cedar Lake.

CDFs are designed to retain and store sediment from hydraulic dredging operations. Conventional hydraulic dredging processes add large volumes of water and result in a slurry of solids being discharged into the CDF. After a given detention time, water from the CDF is discharged into a receiving body, whether a stream, river, or lake. The disposal of dredged material requires that the CDFs provide sufficient hydraulic retention time for settling of suspended solids to meet local, state and Federal effluent water quality standards.

Hydraulic dredging and mechanical dewatering is being performed at Lake Shipshewana in Lagrange County in Northen Indiana. Superior Special Services of Fond du Lac, Wisconsin is dredging 200,000 cubic yards of material for approximately $2 million. Superior Special Services is using two CDFs to contain the dredge materials. The spoils are then sent through a belt press to dewater the sediment. The land owner whose property the CDFs are on is marketing the material as topsoil. Because percent fines are very high for this material, polymers are being added in the CDFs to aid in sedimentation. Eventually Superior Special Services hopes to have the proper equipment available to bypass the CDFs by dewatering the sediment in the filter presses as it is dredged from the lake. Sediment is being pumped at up to 50% solids from 3,200 to 5,600 feet away at a elevation difference of 15 to 20 feet.

4.1 Analytical Approach

In order to size CDFs, a personal-computer-based design, analysis, and evaluation system for dredged material disposal and management was used. Automated Dredging and Disposal Alternatives Management System (ADDAMS) was created by the U.S. Army Corps of Engineers (USACE) in response to requests for tools to evaluate dredged material management alternatives (USACE, 1992). ADDAMS is a set of continually evolving, state-of-the-art, computer-based tools that increases the accuracy, reliability, and cost-effectiveness of dredged material management activities in a timely manner. More specifically, ADDAMS provides necessary tools to perform the engineering and planning evaluation for development of a long-term management strategy for dredged material disposal and to evaluate the environmental acceptability of dredged material management alternatives.

A program module of ADDAMS, entitled SETTLE, was used to facilitate design of the CDF to retain suspended solids, provide initial storage volume, and meet effluent discharge limitations for suspended solids during a dredged material disposal operation. SETTLE implements CDF design procedures described in Engineer Manual 1110-2-5027 (USACE, 1987) and refinements described by Thackston, Palermon, and Schroeder (1998). SETTLE performs CDF design calculations based on data from laboratory settling tests, information on the dredging project, anticipated dredged volumes, dredged material characteristics, expected hydraulic efficiency of the CDF, and desired effluent quality. SETTLE can consider constraints on the CDF design such as dike height and surface area limitations in the design calculations and provides the capacity to consider all CDF design alternatives.

4.2 Preliminary Design

With a maximum sediment depth of approximately 18 feet and an estimated sediment volume of 8.7 million cubic yards (Jones, 1979) dredging of all sediment contained in Cedar Lake is not economically feasible. Phosphorus and nitrogen concentrations are the greatest in the upper 7 to 8 inches of sediment (Jones, 1979). Therefore, the most potential improved water quality benefits for the least cost will result from the removal of this upper layer of sediment.

Two dredge projects were analyzed in detail. Case I involved the removal or 670,000 cubic yards of in-situ sediment. This is the estimated volume of sediment removal that would be required to dredge the upper 7 or 8 inches of the whole lake. Case II involved the removal of 130,000 cubic yards of in-situ sediment. This is the estimated volume of sediment removal that would be required to dredge 7 or 8 inches of sediment from the areas with the highest nutrient concentrations (about 120 acres).

A preliminary design of the CDF was prepared to indicate the size and location of the facility based on the physical properties of the sediment. CDF are typically earthen bermed facilities with top widths of approximately 8 feet and side slopes of 3 to 1. CDFs are generally baffled with interior berms to provide long flow paths, low flow velocities, and sufficient time for sedimentation. Conceptual designs of CDFs for Case I and Case II are shown in Figure 9 and 10. CDFs can be constructed with on-site material obtained from within the disposal pond area. Topsoil should be stripped from within the pond to reach useable materials for berm construction. This excavated topsoil can be stockpiled for later reuse. The excavation will provide additional storage volume for sedimentation in the CDF. Excavation of a pilot channel throughout the pond provides for continued movement of suspended solid slurry throughout the CDF. The final bottom surface of the CDF should be compacted to provide a more impermeable layer, thereby reducing leakage and possible berm failure.

SETTLE was used to size the CDFs shown in Figures 9 and 10. Appendix 4 contains input data sets and outputs from the SETTLE model. Input data include sediment data, settled sand data, production rate and operation time, and disposal area configuration data. Output results include initial storage area requirements using compression settling test data, clarification results using zone settling test data, and effluent quality results using flocculent settling test data. A summary of pertinent findings is presented in Table 4-1.

Table 4-1
SUMMARY OF SETTLE OUTPUT

Item	CASE I	CASE II
Required Surface Area	80 acres	35 acres
Required Storage Volume	142 acre-feet	59 acre-feet
Minimum Berm Height	5.5 feet	5.4 feet
Minimum Depth of Storage	1.8 feet	1.7 feet
Maximum Influent Flow Rate	32 cfs	15 cfs
Minimum Disposal Period	36.7 days	6.3 days
Maximum In-site Volume	913,414 cubic yards	192,213 cubic yards
Minimum Mean Residence Time	114 hours	102 hours
Minimum Depth of Ponding	1.3 feet	1.8 feet
Minimum Ponded Volume	88.3 acre-feet	53.6 acre-feet
Effluent Solids Concentration	9 mg/L	27 mg/L

Analysis of the output suggests that CDFs for Case I and Case II need to be approximately 80 and 35 acres, respectively. The outer berms need to be designed with a minimum height of six feet. This provides for a minium of two feet ponded water, two feet of sediment, and two feet of freeboard. Effluent concentrations from these facilities are expected to be low as shown above.

4.3 Confined Disposal Facility (CDF) Siting

Six potential CDF sites were identified from a review of available maps, based upon proximity of the site to the lake, proximity to an outlet site (stream, lake, river, or wetland), elevation (head) difference, amount of sediment to be dredged, natural topography, amount of potentially available land, presence of environmentally sensitive areas (forests, wetlands), construction access, and construction concerns (i.e, power lines, railroad tracks, tile drains, etc.). Figure 11 identifies the six potential CDF sites as A, B, C, D, E_1, and E_2. Soils in all six sites fall within the following classifications: Pewamo, Elliott, Markham, Morley, and Sparta. All of these soil classes except Sparta have fair to good topsoil, fair to good stability and compaction, medium to high compressibility, and good resistence to piping. Sparta is classified as poor for topsoil. This suggests that all of the facilities would be suitable for construction based on suitability of building materials for construction of berms and dikes. Each of these sites are briefly discussed as follows.

Site A. Site A is approximately 300 acres of farm fields which are bound on the south by 141st Avenue, on the east by Parrish Avenue, on the west by the New York Central Railroad, and on the north by Sleepy Hollow Ditch. This site gently slopes northeast towards Sleepy Hollow Ditch. The site is planted mostly in corn. Notable features include power lines on the east and west boundaries of this property, New York Central Railroad on the west side, one house in the northeast corner of this site, and an underground telephone cable on the south boundary. Site A is approximately 4,000-12,000 feet from areas within Cedar Lake and up to 30 feet higher. This site is owned by two entities, Frank P. Kretz, Jr. and NBD Bank.

Site B. Site B is approximately 400 acres of farm fields, bound on the north by 141st Avenue, on the east by Parrish Avenue, on the west by the New York Central Railroad, and on the south by a drainage inlet leading into the north part of Cedar Lake Marsh. This site gently slopes to the east, southeast towards Cedar Lake Marsh. Notable features include power lines on the east and west boundaries of the property, and the New York Central Railroad on the west side. Figure 12 identifies a small wetland on the extreme west corner of this property. If this site is chosen as a disposal site, care will have to be taken not to fill or impact this wetland. Site B is approximately 4,000-12,000 feet from areas within Cedar Lake and about 30 feet higher in elevation. This site is owned by David Hawkinson, Jr. and Francis S. Schreiber.

Site C. Site C is approximately 700 acres of farm fields, pastures, and wooded sites which are bound on the east by the Monon Railroad, on the west by Parrish Avenue, on the south by 155th Avenue, and on the north by a small stream draining into the north end of Cedar Lake Marsh. The area gently slopes east, southeast toward Cedar Lake Marsh. Notable features include power lines on the east and south boundaries, a few houses on the west and south boundaries, and the Monon Railroad on the east boundary. Figure 12 shows a small wetland in the southeast corner of this site. If this site is chosen for disposal, care will have to be taken not to fill or impact the wetland. Site C is approximately 3,000-13,000 feet from areas within Cedar Lake and up 20 feet higher in elevation. To discharge in this site, piping would most likely cross through Cedar Lake Marsh as this is the closest path. This site is owned by the following entities: David and Harriet Hawkinson, Kenneth Huseman, Bernard Wornhoff, William Poer, and Steven Micic.

Site D. Site D is approximately 275 acres of farm fields which are bound on the west by Morse Street, on the south by 153rd Avenue, on the north by Reeder Road, and on the east by Cedar Creek. This area gently slopes to the east (Cedar Creek) and is currently planted in corn and beans. Notable features include power lines on the west boundary, and houses on the southeast boundary. Figure 12 shows an area of wetlands on the east boundary of this site along Cedar Creek. If this site is chosen for disposal, care will have to be taken not to fill or impact the wetlands. Site D is approximately 3,000-13,000 feet from areas within Cedar Lake and 20 feet higher. This area could be discharged into either Cedar Lake Marsh or Cedar Creek. This site is owned by Charles F. Roberts and Marilyn Hansen.

Site E_1 and E_2. Sites E_1 and E_2 are approximately 150 acres of farms fields which are bound on the south by 141st Avenue, on the west by Parrish Avenue, on the north by Sleepy Hollow Ditch, and on the east by houses along Lauerman Street. These sites gently slopes to the north, northeast towards Sleepy Hollow Ditch and are currently planted in corn and beans. Outlets of tile drains are noted in Sleepy Hollow Ditch in this area. It is assumed that the tile drains serve these sites. Notable features include power lines on the west and south boundaries, houses on the east and southeast boundaries, and the Monon Railroad which splits these two sites. Sites E_1 and E_2 are approximately 1,500-11,000 feet from areas within Cedar Lake and 25 feet higher in elevation. These sites are owned by P. Harvey Hawkinson and Arthur J. Ferrari.

Table 4-2 provides a summary of the potential disposal sites.

Table 4-2
Disposal Site Summary Table

Site Name	Area (acres)	Pipeline Length (ft)	Elevation Change (ft)	Use Concerns
Site A	300	4,000-12,000	30	minimal
Site B	400	4,000-12,000	30	discharge through Cedar Lake Marsh, wetlands
Site C	700	3,000-13,000	20	discharge through Cedar Lake Marsh, wetlands
Site D	275	3,000-13,000	20	discharge through Cedar Lake Marsh, wetlands
Site E_1	80	3,000-11,000	25	Monon Railroad

Site Name	Area (acres)	Pipeline Length (ft)	Elevation Change (ft)	Use Concerns
Site E_2	70	1,500-9,500	25	Monon Railroad

All of these sites would be suitable CDF sites. We recommend that the closest sites be selected if landowner's consent can be obtained, as it will have the lowest project costs. Sites E_1 and/or E_2 are prime for residential development and are split by the Monon Line. For this reason, Site A (Figure 13) has been selected for use in development of the cost estimates. Site A has a convenient drainage swale leading to the proposed constructed wetland on Sleepy Hollow Ditch; the wetland could provide additional treatment of the CDF effluent before it returns to Cedar Lake.

4.4 CDF Reclamation

Sediment removed from Cedar Lake will be of a different quality than native soils of Site A. Upon completion of the dredging project, the CDF will be dewatered and reclaimed. Reclamation will consist largely of regrading and seeding. If necessary a soil amendment can be added to adjust pH.

Existing soil at Site A is predominantly Markam silt loam, with some Elliot silt loam and Pewamo silty clay loam soils. Markam silt loam has a high available moisture capacity and is suitable for intensive cropping, provided good erosion control practices are used. Elliot silt loam requires an adequate drainage system to remove excess water in order to be intensively cropped. Pewamo silty clay loam is also limited by wetness and poor drainage; tilth is poor. Improved drainage is necessary to cultivate this soil.

Textures of these three soil types are compared to sediments from Cedar Lake below (Table 4-3). Without exception, the sediment in Cedar Lake is more coarse than soils at Site A. This strongly suggests that the sediments will not increase water logging of the soils. The high nutrient and organic contents of the sediment, together with the coarser texture, indicate it will be suitable for agricultural use following the dredging. We do recommend that the dredge contractor have the soils at the CDF tested to assess the possible need for amendments (pH adjustment) prior to return of the land to agricultural production.

PCBs were not detected in any of the ten sediment samples analyzed. During the design stage, we also recommend that additional testing be performed to determine the presence of other contaminants in the sediment: copper, arsenic, mercury, herbicides and insecticides although IDEM historical testing suggests no concerns (Appendix 3).

Table 4-3
COMPARISON OF LAKE SEDIMENT QUALITY AND LAND SEDIMENT QUALITY

	% Passing Sieve					Depth to Water Table (ft)
Soil or Sediment	No. 4 (4.7 mm)	No. 10 (2 mm)	No. 40 (.42 mm)	No. 200 (0.074 mm)	% < 0.02 mm	
Markam silt loam	96-100	90-100	93-97	89-96	68-87	>4
Elliott silt loam	99-100	97-99	92-95	83-88	72-74	1-4
Pewamo silty clay loam	99-100	95-100	95-100	80-85	no data	0-1
Sample No.						
SS10	100	100	65	44	0	
SS10 (duplicate)	100	100	74	46	20	
SS15	100	99	97	88	54	
SS12	100	100	86	74	16	
SS17	100	100	95	12	0	
SS14	100	100	68	34	0	
SS16	100	100	69	47	0	
SS08	100	100	65	45	0	
SS11	100	100	92	3	0	
SS09	100	100	72	52	15	
SS13	100	100	74	60	17	
SS21	100	100	92	75	5	
SS02	100	100	72	54	11	
SS02 (duplicate)	100	100	66	46	6	
SS01	100	100	97	58	13	
SS06	100	100	59	37	5	
SS04	100	100	65	37	4	
SS03	100	100	67	41	3	
SS19	100	100	85	52	5	

	% Passing Sieve					Depth to Water Table (ft)
Soil or Sediment	No. 4 (4.7 mm)	No. 10 (2 mm)	No. 40 (.42 mm)	No. 200 (0.074 mm)	% < 0.02 mm	
SS07	100	100	75	53	9	
SS05	100	100	92	47	19	
SS20	100	100	87	60	25	
SS22	100	100	99	66	6	
SS18	100	100	68	38	4	

4.5 Cost Estimates

Tables 4-4 and 4-5 present estimated construction costs based on the two dredge cases under study, Case I and Case II. The following assumptions were used in estimating costs:

- Actual dredging operation will be done approximately 60 hours per week excluding maintenance, breakdowns, weather, or other delays. Dredging more than 60 hours per week may affect the ability to meet the estimated effluent criteria.
- Dredging production rate:
  - Case I: 400 cubic yards of material per hour
  - Case II: 350 cubic yards of material per hour
- The influent discharge flow from the dredge pipeline to disposal pond:
  - Case I: ~ 18 cfs
  - Case II: ~ 12 cfs
- The dredge pipeline inner diameter:
  - Case I: 14 inches
  - Case II: 12 inches
- The maximum distance from Cedar Lake to the disposal pond is 9,000 feet
- The dike freeboard is maintained at a minimum of 2 feet.
- The pond water depth within the dikes is 2 feet.

Table 4-4
CASE I COST ESTIMATE (670,000 cubic yards, 80 acres CDF)

Description	Estimate	Unit	Unit Price	Total
Mobilization	-	LS	-	$283,500
Clearing , Grubbing, and Striping	100,000	CY	$1.90	$190,000
Common Excavation	147,828	CY	$1.42	$209,916
Earthfill	104,260	CY	$1.01	$105,303
Impervious Fill	27,820	CY	$3.50	$97,370
Rip-rap	1,720	TONS	$34.00	$58,480
Rip-rap embedded in Concrete (Grounted Rip-rap)	920	TONS	$54.00	$49,680
Filter Fabric	960	SY	$6.75	$6,480
Rockfill	1,200	CY	$27.00	$32,400
Bedding Material	12	CY	$20.25	$243
Reinforced Concrete	150	LF	$135.00	$20,250
Corrugated Steel Culvert	320	LF	$40.50	$12,960
Cast in Place Concrete, including Formwork, Accessories	-	LS	-	$37,800
Topsoil, Min. 8" Thick	62,345	SY	$0.69	$43,018
Seeding and Fertilizing	5,200	LB	$1.35	$7,020
Mulching	20	AC	$1,350.00	$27,000
Miscellaneous Metal including Handrails, Trash racks, etc.	-	LS	-	$6,750
Floating Skimmer	-	LS	-	$3,240
Sluice Gate	-	LS	-	$4,050
Plugging Existing Drain Tiles	10	EACH	$675.00	$6,750
Reclamation Plan	-	LS	-	$20,200
Dredging Cedar Lake	670,000	CY	$4.83	$3,236,100
Security Fence	7,965	LF	$12.83	$102,191
Double Swing Gates	4	EACH	$810.00	$3,240
Dewatering	-	LS	-	$57,500
Subtotal				$4,621,440
Contingency @ 15%				$693,216
Surveying/Engineering/Administration @ 8%				$369,715
Subtotal (Construction and Engineering)				$5,684,372
Land Leasing Costs: 80 acres for 2 years @$150/acre/year				$24,000

Description	Estimate	Unit	Unit Price	Total
Total				**$5,708,372**

Table 4-5
CASE II COST ESTIMATE (130,000 cubic yards, 35 acres CDF)

Description	Estimate	Unit	Unit Price	Total
Mobilization	-	LS	-	$202,500
Clearing , Grubbing, and Striping	44,000	CY	$1.90	$83,600
Common Excavation	66,930	CY	$1.42	$95,041
Earthfill	46,115	CY	$1.01	$46,576
Impervious Fill	12,305	CY	$3.50	$43,068
Rip-rap	1,290	TONS	$34.00	$43,860
Rip-rap embedded in Concrete (Grounted Rip-rap)	690	TONS	$54.00	$37,260
Filter Fabric	720	SY	$6.75	$4,860
Rockfill	900	CY	$27.00	$24,300
Bedding Material	12	CY	$20.25	$243
Reinforced Concrete	150	LF	$135.00	$20,250
Corrugated Steel Culvert	320	LF	$40.50	$12,960
Cast in Place Concrete, including Formwork, Accessories	-	LS	-	$34,000
Topsoil, Min. 8" Thick	33,700	SY	$0.69	$23,253
Seeding and Fertilizing	2,600	LB	$1.35	$3,510
Mulching	10	AC	$1,350.00	$13,500
Miscellaneous Metal including Handrails, Trash racks, etc.	-	LS	-	$6,750
Floating Skimmer	-	LS	-	$3,240
Sluice Gate	-	LS	-	$4,050
Plugging Existing Drain Tiles	10	EACH	$675.00	$6,750
Reclamation Plan	-	LS	-	$14,400
Dredging Cedar Lake	130,000	CY	$4.83	$627,900
Security Fence	5,400	LF	$12.83	$69,282
Double Swing Gates	4	EACH	$810.00	$3,240
Dewatering	-	LS	-	$30,800
Subtotal				$1,455,192
Contingency @ 15%				$218,279
Surveying/Engineering/Administration @ 22%				$320,142

Description	Estimate	Unit	Unit Price	Total
Subtotal (Construction and Engineering)				$1,993,613
Land Leasing Costs: 35 acres for 2 years @$150/acre/year				$10,500
Total				**$2,004,113**

The dredging project at Lake Shipshewana in Lagrange County is under contract for the removal of 200,000 cubic yards of sediment at a price of approximately $7 per cubic yard of material. The construction of two CDFs, which cover approximately 40 acres, was estimated at $350,000. These costs exclude surveying, administration, and engineering. Superior Special Services stated that some bids for this project came in at three times this amount.

4.6 Funding Sources

We have identified three potential sources of financial assistance for the CLEA to dredge Cedar Lake. These include:

- Section 314/319 Programs
- State Revolving Loan Fund (SRF)
- LARE/Build Indiana Fund

The USACE is responsible for navigation in public waterways and will only dredge navigation channels in designated areas. The United States Environmental Protection Agency (USEPA) has historically supported some dredging of public lakes in Region 5 through the Clean Lakes (Section 314) Program, but not in Indiana. Currently, the USEPA has rolled funding for 314 into the Non-Point Source Program (Section 319), so application would be made to that funding source. In the fiscal year 1997-1998, the Section 319 Program in Indiana funded 14 projects for a total of $2.3 million; 65 grant requests were reviewed. In the future, while funding for this program is expected to remain the same or increase, recipients in targeted watersheds will be given preferential treatment. Cedar Lake is in the Kankakee River Watershed and is currently not a targeted watershed by IDEM. Under the 319 Program, a 25% local cost-share is required and an upper limit of $112,500 is enforced.

The SRF was created by the Clean Water Act Amendments in 1987 and has most commonly been used to finance municipal wastewater collection and treatment projects. Indiana's SRF Program offers low-interest loans to qualified communities for the planning, design, and construction of publicly-owned wastewater facilities. The SRF currently provides the lowest cost financing for these wastewater projects. The program is jointly managed by the IDEM and the State Budget Agency (SBA). IDEM is SRF Program administrator and the SBA is financial manager. Currently, IDEM is revising its policy and, in about two years, when the policy goes into effect, nonpoint source projects will be eligible for SRF financing. Together, the EPA and the State of Indiana have provided over $342 million to the SRF through 1998. Although future funding is uncertain, the program will be self-sustaining through the repayment of the loans. Communities eligible to apply for SRF loans are political subdivisions including incorporated cities and towns, counties, townships, municipal corporations, conservancy districts, sanitary districts, and regional water, sewer and waste districts.

The 1995 session of the General Assembly passed Senate Bill 66 to provide a three tiered interest rate policy for the SRF program. The new policy allows the SRF program to be more affordable to communities, especially Indiana's poorer communities. The interest rate available to a community is based on the median household income (MHI) of the service area. In addition, a community may be eligible for 0% interest for up to two years depending upon the communities' MHI. The interest rate policy is outlined in the table below.

Table 4-6
SRF INTEREST RATE POLICY

Tier	Median Household Income (MHI)	Interest Rate *	0% Period
Base	greater than 100% of the State nonmetropolitian MHI > $31,242	3.90	--
Intermediate	greater than 80% up to and including 100% of the State nonmetropolitian MHI over $24,994 but <= $31,242	3.50	1 year
Reduced	less than or equal to 80% of the State nonmetropolitian MHI $24,994	2.90	2 years

* Interest rates will remain in effect at least until the proceeds of the currently outstanding revenue bonds have been fully committed

Currently, the State of Indiana is assisting with the financing of dredging Lake Shipshewana in Lagrange County. This project is budgeted for about $1.5 million and is financed through the Build Indiana Fund. The project's local sponsor is the Lake Shipshewana Community Improvement Association. The LARE program is providing technical oversight. Without this special source of funding, LARE would not be able to be involved, as dredging projects are beyond their normal financial capabilities.

4.7 Permit Requirements

Several different state and federal permits and approvals are required The State of Indiana Department of Natural Resources (IDNR) requires a joint permit application for construction within a floodway of a stream or river, navigable waterway, public fresh water lake, and ditch reconstruction. The joint application can be used for: (1) alternation of the bed or shoreline of a public freshwater lake; (2) construction or reconstruction of any ditch or drain having a bottom depth lower than the normal water level of a freshwater lake of 10 acres or more and within ½ mile of the lake; (3) construction within the floodway of any river or stream; (4) placing, filling, or erecting a permanent structure in; water withdrawal from; or material extraction from; a navigable waterway; (5) extraction of mineral resources from or under the bed of a navigable waterway; and (6) construction of an access channel.

The Indiana Department of Environmental Management requires a Section 401 Water Quality Certification (WQC) to conduct any activity that may result in a discharge into waters of the United States. In general, anyone who is required to obtain a permit from the USACE to engage in dredging, excavation, or filling activities must obtain a WQC.

The Detroit USACE requires permits authorizing activities in, or affecting, navigable waters of the United States, the discharge of dredged fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping into ocean waters.

The IDEM Rule 5: Storm Water Runoff Associated with Construction Activity, is intended to reduce pollutants in storm water discharges into surface waters of the state. The requirements of Rule 5 apply to all persons who are involved in construction activity that results in the disturbance of five acres or more or total land area.

A Dam Safety Permit is required by the IDNR if the area of concern meets at least one of the following three requirements: watershed area of 1 square mile and greater, dam height of at least 20 feet, and a detention volume of 100 acre-feet. A detention volume of 100 acre-feet will be exceeded in Case I, but not Case II.

Table 4-7
PERMIT REQUIREMENTS

	Case I	**Case II**
Floodway Permit	●	●
401 Certification	●	●
USACE Permit	●	●
IDEM Rule 5	●	●
Dam Safety	●	

5.0 BENEFITS

While Chapter 4 evaluated the costs of lake dredging, this chapter focuses on benefits. Most environmental benefits are difficult to quantify in economic terms; but, techniques to do this are available. Typically, monetizing environmental benefits requires substantial local and regional data on the use of, and willingness to pay for, these benefits. In general, these data are not available for Cedar Lake, Lake County, or northwest Indiana. We have identified environmental benefits and quantified them to the extent possible within the constraints of data availability and budgetary resources.

5.1 Water Quality

The effects of alternative lake and watershed management measures on water quality can be estimated using empirical equations, such as those described by Chapra (1997). We refined the lake response predictions developed earlier (Harza 1998) to estimate the water quality benefits of reduced internal phosphorus loadings. This model incorporates the limiting nutrient concept, that is, it assumes that reductions in the nutrient source that controls primary production will reduce algae biomass in Cedar Lake. Examination of recent water quality data, and comparison of nitrogen-to-phosphorus ratios in water with the stoichiometric nutrient requirements of phytoplankton, confirms phosphorus to be the nutrient limiting primary production in Cedar Lake.

Effects on lake water quality were estimated in a two-fold procedure. First, loadings to the lake from all sources were estimated using the unit areal loading concept. Then, the loadings were routed through the lake using an empirical equation that incorporates the two principal phosphorus sinks in lakes: flushing and sedimentation.

Land uses of the Cedar Lake watershed are tabulated below (Table 5-1); agriculture predominates, but significant urban and wetland areas are also noted in the watershed.

Table 5-1
LAND USE/COVER IN THE CEDAR LAKE WATERSHED

Land Use/Cover	Area (ac)	Area (ha)
Residential	855	346
Commercial & Industrial	85	35
Wetland	419	170
Forest	134	54

Land Use/Cover	Area (ac)	Area (ha)
Golf Course	116	47
Agriculture	3,015	1,220
Total	4,624 ac	1,872 ha

Phosphorus exported from these land use areas were estimated as the product of phosphorus export coefficients (Table 5-2) and land areas. Other sources included in the loadings estimate were atmospheric deposition and internal loadings, the latter derived in an earlier study by Echelberger *et al.*, 1979. The sum of all loadings, under baseline, or current, conditions was estimated to be 10,100 kg P/yr (Table 5-3). Phosphorus loadings under several future scenarios, reflecting alternatives lake management measures, were developed from this baseline model.

Table 5-2
UNIT AREA PHOSPHORUS EXPORT COEFFICIENTS (kg/ha-yr)

Source	Export Coefficients
Residential	1.5
Commercial & Industrial	1.5
Wetland	-0.2
Forest	0.1
Golf Course	3
Agriculture	3
Atmosphere	0.3
Sediments	18

The earlier report by Harza estimated the effectiveness of alternative watershed management measures, and recommended development of a constructed wetland on Sleepy Hollow Ditch. Assumptions for phosphorus removal efficiencies in that model included a phosphorus removal efficiency of 42% for the constructed wetland and internal phosphorus loading reductions of 50% for dredging.

The response of lake water quality to these changes in nutrient loadings were estimated using the following equation:

$$P = 0.1 \cdot \frac{L/A}{11.6 + 1.2 \cdot q_s}$$

where P is the mean annual lake total phosphorus concentration (mg/L), L is total phosphorus loadings to the lake (kg/yr), A is the lake surface area in hectares, and q_s is the surface hydraulic loading rate, estimated to be 2.1 m/yr.

Refinements to the lake phosphorus loading estimates are appropriate, given the two dredging cases under evaluation. For dredging the entire lake, Case I, we estimate that this would reduce internal sources of phosphorus loading by 80%. For the less extensive dredging case, Case II, partial lake dredging to remediate "hot spots", we estimate that this will reduce internal sediment phosphorus loading by 50%.

Table 5-4 provides the results of the lake response computations. Figure 16 illustrates the phosphorus budgets for these two scenarios.

Under both dredging scenarios, including the development of a constructed wetland, Cedar Lake is predicted to remain eutrophic. Most limnologists define eutrophic lakes as those with mean annual total phosphorus concentrations greater than about 0.02 mg/L. If this were our restoration goal, phosphorus loadings to Cedar Lake will need to be reduced to 900 kg/yr, or less than ten percent of current loadings! We believe that 0.02 mg/L of phosphorus, or mesotrophy, is an inappropriate restoration goal for Cedar Lake, in view of the relatively high hydraulic retention time and large lake volume.

Table 5-3
PHOSPHORUS LOADING ESTIMATES (kg/yr) UNDER BASELINE AND ALTERNATIVE LAKE MANAGEMENT MEASURES

Source	Baseline Conditions	Proposed Wetland	Wetland + Full Lake Dredging	Wetland + Partial Lake Dredging
Sleepy Hollow Ditch Subbasin	1,362	690	690	690
Cedar Lake Marsh	756	756	756	756
Rest of watershed	2,224	2,224	2,224	2,224
Sediment	5,689	5,689	1,138	2,845
Atmosphere	95	95	95	95
Total	10,126	9,454	4,903	6,610

Table 5-4
LAKE RESPONSE ESTIMATES

Source	Baseline Conditions	Proposed Wetland	Wetland + Full Lake Dredging	Wetland + Partial Lake Dredging
Total phosphorus concentration (mg/L)	0.23	0.22	0.11	0.15
Chlorophyll a concentration (µg/L)	39	37	23	28

Sources of uncertainty in these lake response estimates are significant. Principal uncertainty factors inherent to this include:

- Use of an empirical model developed from other North American lakes to estimate mean annual phosphorus concentrations; Cedar Lake is, at best, on the margins of the hydraulic and chemical ranges reflected in the data set used to build Reckhow's model.
- Uncertainty regarding the unit area loading coefficients.
- Predicting Secchi disk depth (as an estimator of lake clarity) is not possible for Cedar Lake because much of the lake's turbidity is resuspended solids from boat traffic, wind-generated waves, and roiling of the bottom by carp.

The uncertainty associated with the baseline model was estimated through the computation of confidence limits. There is a 90% chance of the actual mean annual phosphorus concentration (of the baseline lake) lying between 0.10 and 0.41 mg/L; recent grab sample measurements are well within this range.

5.2 Socioeconomics

The economic benefits and costs of water resources projects have been well defined by water resource agencies, resource economists, and regional planners, and standardized methodologies have been developed to assess such values (USACE 1995, Economic Principles and Guidelines Technical Appendix; Goodwin 1984; U.S. Water Resources Council 1983).

A water resource project's economic benefits and key impacts are primarily described in terms of direct net and secondary (or regional) economic values: measures of economic value that are conventionally applied within standard water resource evaluations. Direct value refers to the economic benefits derived from primary economic activities or sectors, such as a reliable water supply for municipal uses or the value individuals place on recreational opportunities. Direct net value represents the net benefits derived from primary economic activities, over and above the costs of providing such activities (or the avoided costs). Secondary or regional economic benefits refer to measures of local income or employment, or expenditures generated by the direct economic activities. Secondary or regional economic benefits (or values) are a distinct category of economic activity are separate from direct benefits when considering contributions to national economic development (NED accounting) or activity.

The distinction between direct and secondary values can be important when considering project development funding sources. If federal funds are sought, then direct net values are the primary criteria for justifying project expenditures (such as funding provided from Congressional appropriations to the USACE or Bureau of Reclamation). Whereas state and local governments are usually more concerned about the project impacts to regional or local income. The federal perspective is on net benefits to national economic development (NED accounting), while the state-local perspective focuses on regional income and employment impacts.

Other benefits can accrue to local areas through taxation changes and improvements to community infrastructure. For example, if local land and property values increase due to increased demand, additional tax revenues are usually generated to provide for the costs of new or improved infrastructure. While the costs of new infrastructure can be distributed to existing and new residents in different ways with different equity considerations (such as special impact fees for new developments), the resulting improvements to community quality-of-life are often perceived as being positive, particularly where services are limited. Also, improvements to community infrastructure usually induce additional private sector investments and enhanced economic activity. For the Cedar Lake community, improvements to lake water quality could affect direct and secondary economic values. Both types of values should be considered in evaluating economic benefits associated with water quality improvements.

5.2.1 General Social and Economic Characteristics

Lake County is located about 40-miles south-east of the greater Chicago area and is home to many suburban commuters. The County population has fluctuated in the past, with a population high of over 500,000 in 1970, then declining to about 475,000 residents in 1990. The population is currently increasing and is estimated to be about 483,000 (U.S. Census data, 1995 estimate).

Within Lake County, per capita income is about $21,000 and accounts for about 8% of the state's total personal income (U.S. Bureau of Economic Analysis 1995 data). The leading economic sectors are: primary metals manufacturing, general building construction, chemical and petroleum products, health services, and business services.

Since 1970, the population of Cedar Lake has been increasing, with a current estimate of about 9,500 residents (NIPSC 1997). The community attracts urban and industry commuters, retirees, and others. "Basic" industries and business activities within Cedar Lake are limited to a relatively small number of firms, with the community largely being service-oriented in nature. Cedar Lake is viewed as an attractive community for those who prefer a "small-town" environment, with water-based and outdoor recreation opportunities available and nearby.

Due to the nature of early land development in Cedar Lake as a resort community, housing units, lot sizes, and property values are highly mixed within the community. But with new construction and housing development occurring, more modern-style housing units are becoming the norm. For housing actively on the market, the town's average residential unit is valued at about $86,800 (NW Indiana Realtors Association estimate).

5.2.2 Direct Net Economic Value Changes

5.2.2.1 Recreation Values

The Cedar Lake fishing, boating, camping, and day-use recreation activities retain direct net values. Direct net value for recreation activities represents a nonmarket economic value. This value reflects the value individuals would be willing-to-pay to engage in such recreational activities that exceeds individuals' actual costs of participation (consumer surplus value). Economists estimate direct net value through elaborate travel cost models, contingent valuation method (CVM) surveys and studies, and other means. During the past thirty years, consistent standards and practices have been employed to conduct economic analyses for recreation activities (Walsh 1994; Olsen, et al., 1991; USACE 1995).

Although specific estimates for sport-effort and day-use activities for Cedar Lake are not available (no readily available data could be obtained from state agency or local sources to make an accurate estimate), it is possible to illustrate the economic value of such activities by describing the recreation value levels that have been assigned to similar recreation activities in other areas.

For example, the U.S. Army Corps of Engineers and other federal agencies have surveyed (or analyzed) numerous areas to estimate recreation values (USACE 1995; USFS 1990; Walsh 1984). For warm-water fisheries, these estimates suggest a direct net economic value ranging between $35-$60 (1998 dollars) per sport-effort day; about $15-$25 for general boating activities, and about $20-$30 per sport-effort day for general day-use activities (picnicking, sight-seeing, hiking). Also, note that these values are very general in nature and can vary greatly depending on the actual location and demand conditions. In places of high demand, these value levels could be exceeded.

Based on current information obtained from marina and recreation facility owners/managers, demand for the Cedar Lake recreation opportunities is viewed as high and growing. The existing facilities provide for over 200 seasonal boat-mooring slips and additional day-use boating access. Some marina owners/managers are actively pursuing expansion plans and are considering new types of water-based business ventures. Therefore, water quality factors are perceived as being important to the growth of the local recreation industry.

Currently, the state is not actively stocking Cedar Lake for enhanced fishing opportunities, and fishing opportunities are limited to select warmwater species. But local marina owners/managers have discussed future stocking opportunities with state fish biologists, and either state or private stocking opportunities could be pursued, if water quality improvements occurred. This would likely further stimulate fishing demand on the lake given more catch options.

In general, the demand for outdoor recreation opportunities is high throughout the state. The Statewide Outdoor Recreation Participation Survey (IDNR 1994) suggests that a significant number of state residents engage in water-based recreation activities and related uses. State-wide goals from the research review include: to improve recreation planning, to expand local recreation opportunities, and to acquire adequate funding for out-door recreation opportunities from local, state, and federal sources.

By using the types of economic recreation data described above (general values), estimates can be presented for increases to Cedar Lake recreation activity (direct net value). If it is assumed that demand is high, then on an annual basis, an additional 500 sport-effort fishing days could be valued at about $30,000; an additional 500 boat-use days could be about $12,500; and an additional 500 day-use days could be about $15,000. These values illustrate marginal value improvement in general, and do not depict site-specific conditions at the lake; nor do they include secondary or regional value impacts.

5.2.2.2 Wildlife Habitat Improvements

Direct net economic value estimates to improve or expand wildlife habitat, for water fowl or wildlife dependent on riparian zones, are usually based on the "replacement" value or purchase value of land and water resources (either in terms of dollars per acre or acre-ft. of water required). As such, these values are very site specific in nature. For example, the value can range from a few hundred dollars per acre to several thousands of dollars per acre depending on location and the wildlife resources affected.

If water quality improvements to Cedar Lake directly improve wildlife habitat, then estimates of economic value could be determined based on land surveys and habitat and wildlife inventories for the area. This would suggest that additional direct net value should be attributed to wildlife habitat enhancements, as provided by water quality improvements to Cedar Lake. However, in general, waterfowl populations are not limited by water quality and improvements to Cedar Lake would not likely affect populations or hunting opportunities.

5.2.2.3 Residential Land and Property Values

Although residential land value changes usually (can) fall within the category of secondary impacts, changes to land values adjacent to Cedar Lake may be more appropriately classified as direct economic impacts. This would be similar to land value changes, where adding water to the land for irrigation purposes creates new or additional direct values--the increased value of the land is the value of water. In the case of Cedar Lake, the direct effects to land and property values would stem from improvements to water quality (as opposed to general increases in local economic activity).

At the present time, data from the Northwest Indiana Realtors Association and information received from Cedar Lake Realtors suggest that lake-front properties command higher prices than comparable non-lake-front properties within the Cedar Lake area. The lake-front properties (and lake view properties) appear to retain asking prices (not market clearing prices) about 25-40% greater than the other properties (many lake-front properties exceeding $100,000 in value). Realtors also indicate that the demand for lake-front properties is very high, with potential home owners and developers making regular inquiries.

Although a subjective assessment, Cedar Lake Realtors anticipate that any changes to lake water quality would likely enhance the demand for lake-front (and view) properties, thus increasing land values. Conducting property inventories is beyond the scope of the analysis presented here, so accurate estimates of potential changes to total land and property values are not readily available. But it can be assumed that relatively small changes to property values could represent several hundred thousands, or millions, of dollars of increased value. For example, if 100 properties valued at $50,000 each increased in value by 10%, the total value increase would be $500,000.

5.2.2.4 Option-Existence Values and Perceived Quality-of-Environment Improvements

The economic value of water can be expressed in terms of direct net value per acre-foot of water used for specific sectors, such as fisheries, recreational activities, and wetlands restoration (to improve recreation opportunities) (for example, see Olsen and Ziari 1998). The economic value of these sectors is described as "use value."

But other environmental resource values (or amenity values) are predominantly an expression of non-use, nonmarket values that are estimated through CVM surveys. These surveys attempt to capture society's willingness-to-pay for resource condition improvements; this additional willingness-to-pay, if accurate, is an estimation of direct net value. Depending on the resource being measured, this value estimate can be interpreted to represent "total value," that is, society's combined use value, option value, and existence value.

Option value (or option price, where resource use already exists along with an option to use the resource under some improved state of conditions) refers to the option of being able to use the resource in the future, given some change of conditions, such as with resource enhancement or improvements. Existence value refers to the value society places on simply knowing that a resource exists.

Both option (future resource use) and existence values could be relevant to a decision to improve water quality at Cedar Lake. It is likely that the area's residents do hold some undefined level of option (future use value) or existence value that would be attached to environmental enhancement. These types of values could be estimated via CVM survey techniques, to establish additional direct net value (willingness-to-pay for water quality improvements).

5.2.3 Secondary and Regional Economic Values

Secondary and indirect values represent changes to income and employment caused by increases to direct expenditures (such as recreation related expenditures) and indirect expenditures, as the purchases of goods and services "flow" through an economy. This secondary level of economic change and dependence is often referred to as the multiplier effect. There are several types of methods that can be used to measure the multiplier effect for specific types of localized economic activity--these include economic base analysis and input-output models. There also are different types of multipliers, but the most relevant multiplier to depict local impacts is an income or employment multiplier.

5.2.3.1 Recreation Values

Survey estimates are normally used to assess the expenditures associated with recreation activities and sport-effort days. These types of surveys have not been conducted for the Cedar Lake area, but the relative magnitude of such expenditures can be reviewed from other sources. For example, the USACE (and others) suggests that water-based recreation expenditures in the West (not including salmon or steelhead sport fisheries) range from about $10 to $50 (or higher) per sport-effort day, per user (1995 dollars). Non-residents typically spend more than residents for sport-effort activities. These expenditures contribute to direct and indirect income and employment.

Several studies have been conducted to estimate the multiplier effects from recreation sector expenditures, including flat-water recreation areas (see for example Olsen, et al. 1994; USACE 1995; Walsh 1984). At the local (county-wide) level, income or employment multipliers tend to fall within a 1.5 to 2.0 range (state-wide multipliers are higher).

In the case of recreation activity within the Cedar Lake area, it is reasonable to assume that for every dollar of income derived from direct recreation expenditures, an additional 1.5 to 2.0 dollars of income is generated from indirect expenditures associated with the recreation activity.

5.2.3.2 Land and Property Tax Base Changes

To the extent that water quality improvements improve the perception of Cedar Lake as a favorable community to live in, demand for residential housing will increase, and some level of service business will increase, as well. In turn, increased housing demand will move upward land and property prices, in general.

Increased property values and local expenditures will increase tax revenues available to support the demand for new public services and infrastructure improvements--the social overhead costs associated with population and housing growth. No attempt is made here to estimate either increased tax revenues or social overhead costs.

5.3 Summary of Economic Benefits

Based on the observations and analyses described above, the following economic benefits would likely be derived from improved water quality levels at Cedar Lake:

- The direct net value for recreation activities--fishing, boating, day-use activities--would increase, given an increase in demand for recreation use and additional sport-effort days.

- Secondary economic values would increase--income and employment--from added recreation use and more expenditures within the community.

    - Direct land values would increase for lake front (and view) properties.

    - Wildlife habitat and riparian economic values would increase.

- To some extent, nonmarket option and existence values would increase (or the current value level could be quantified).

- General income and employment levels would increase from additional business activity associated with population growth.

- Tax revenues would increase to support public service needs and infrastructure (social overhead costs).

- The overall economic impact would likely result in more social and environmental amenities for local residents--the result of improved environmental conditions, enhanced recreation opportunities, some increases to population and visitation, and additional services and business activities made available.

6.0 CONCLUSIONS

Past investigations identified internal recycling of nutrients from lake sediments as a main contributor to degraded water quality in Cedar Lake. Harza collected 22 sediment samples for analysis for sediment quality parameters. These results were used to delineate areas for dredging which would remove the most contaminated sediments.

Given the large volume of sediment contained in Cedar Lake, estimated at 8.7 million cubic yards (Echelberger, et al., 1979), dredging all sediment contained in Cedar Lake is not economically feasible. Historical sampling indicated that the top seven or eight inches of sediment contained the largest amounts of nutrients (Echelberger, er al., 1979). Therefore, the most potential improved water quality benefits for the least cost will result from the removal of this upper layer of sediment.

Given the size of dredging project required at Cedar Lake, hydraulic dredging with disposal and dewatering of dredged material in CDFs was determined the most appropriate. Dredging designs, performed using SETTLE computer software developed by the USACE, were based on two cases: Case I and Case II. Case I involved the removal of 670,000 cubic yards of in-situ sediment. This is the estimated volume of sediment removal required to dredge the upper seven or eight inches of sediment. Case II involved the removal of 130,000 cubic yards of in-situ sediment. This is the estimated volume of sediment removal that would be required to dredge seven or eight inches of sediment from the areas of the lake with the highest nutrient concentrations (about 120 acres). CDF sizing calculations performed using SETTLE indicated a disposal facility with a minimum berm height of 6 feet and a surface area of 80 acres and 35 acres for Case I and Case II, respectively.

Six potential locations for CDF siting were studied. All sites are suitable for CDF siting; therefore, the closest obtainable site to Cedar Lake is preferred. It is estimated that pumping to any of these six sites will range from a distance of 1,500 feet to 13,000 feet with a change in elevation of +20 feet to +30 feet.

Costs estimates were calculated from Case I and Case II. Case I, which is the removal of 670,000 cubic yards requiring a CDF of 80 acres, is estimated to cost $5.7 million. Case II, which is the removal of 130,000 cubic yards requiring a CDF of 35 acres, is estimated at $2.0 million. These cost estimates include construction, engineering, and land leasing costs.

Potential funding sources for removal of sediment from Cedar Lake include:

- Section 314/319 Programs
- State Revolving Loan Fund (SRF)
- LARE/Build Indiana Fund

All these programs require cost share requirements and the most promising seem to be the Build Indiana Fund and the SRF.

The effects of alternative lake management measures on water quality was estimated using empirical equations. For Case I, we estimate that dredging will reduce internal sources of phosphorus loading by 80%. This, coupled with the development of the proposed constructed wetland (Harza, 1998), will reduce phosphorus loadings by 52%. For Case II, we estimate that dredging will reduce internal sources of phosphorus loading by 50%. This, coupled with the development of the proposed constructed wetland, will reduce phosphorus loadings by 35%. Under both dredging scenarios, including the development of a constructed wetland, Cedar Lake is predicted to remain eutrophic.

Economic benefits will likely be derived from improved water quality levels at Cedar Lake. Recreation activities such as fishing, boating, and day-use activities will increase, given an increase in demand for recreation use. Secondary economic values such as income and employment will increase resulting from added recreation and more expenditures within the community. General income and employment levels will increase from additional business activity associated with population growth. Direct land values would increase for lake front (and view) properties. The overall economic impact will likely result in more social and environmental amenities for local residents.

7.0 REFERENCES

Department of Natural Resources, 1994. Statewide Outdoor Recreation Participitation Survey, 1993. State of Indiana, DNR internet site, 1998; and review of related recreation and fisheries data sets and information.

Echelberger, Jr., W.F., Jones, W.W., and others, 1979. Cedar Lake Restoration Feasibility Study, Environmental Systems Application Center, School of Public and Environmental Affairs, Indiana University, Bloomington, IN.

Echelberger, Jr., W.F., Jones, W.W., and others, 1984. Cedar Lake Restoration Feasibility Study - Final Report, Environmental Systems Application Center, School of Public and Environmental Affairs, Indiana University, Bloomington, IN.

Goodwin, A., et al., 1984. Principles of Water Resource Planning. New Jersey, Englewood Cliffs: Prentice-Hall, Inc.

Jones, W. W. and Marnatti, J., 1991. Cedar Lake Enhancement Study - Final Report, Environmental Systems Application Center, School of Public and Environmental Affairs, Indiana University, Bloomington, IN.

Northen Indiana Public Service Company, 1997. Community Analysis for Cedar Lake, Indiana. NIPCS. Provided by Cedar Lake Chamber of Commerce, 1998.

Olsen, D., et al., 1991. Sport and Existence Values for Columbia River Basin Salmon and Steelhead, RIVERS, 1991.

Olsen, D., et al., 1994. An Economic Analysis of the Rogue River Sport Fisheries. Report prepared for the Oregon Department of Fish and Wildlife. Pacific Northwest Project, Kennewick, Washington.

Olsen, D. and H. Ziari, 1998. Western Irrigated Agriculture Economic Benefits Review, 1998. Pacific Northwest Project, Kennewick, Washington. Source includes review of water values for recreation and environmental benefits throughout the Western U.S. contained within U.S. Army Corps of Engineers and USBR environmental impact statements and other sources.

Plafkin, J.L., Barbour, M.T., Porter, K.D., Gross, S.K., and Hughes, R.M., 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers - Benethic Macroinvertebrates and Fish, EPA/444/4-89-001. Environmental Protection Agency, Washington, DC.

United States Bureau of the Census, 1998. Population Characteristics for State and Counties, internet data site.

United States Bureau of Economic Analysis, 1998. Local Area Income and Employment Data Series, 1993-1995. Internet site data base, 1998; and Indiana Business Review, Kelley School of Business, Indiana University, July 1998.

United States Army Corp of Engineers, 1995. HEC-RAS River Analysis System, Hydraulic Reference Manual, Version 1.0.

United States Army Corps of Engineers, 1995. System Operation Review EIS and Technical Appendices for Economics and Recreation (includes Western recreation value survey). Portland, Oregon, North Pacific Division, 1995. Sources also provides updated economic principles and guidelines for evaluation of water resources projects.

United States Department of Agriculture, Soil Conservation Service, 1992. Soil Survey of Lake County, Indiana.

United States Department of Interior, Fish and Wildlife Service, 1981. National Wetlands Inventory Quad Maps of Lowell, Indiana and St. John, Indiana.

United States Environmental Protection Agency, 1974. The Relationships of Phosphorus and Nitrogen to the Trophic State of Northeast and North-Central Lakes and Reservoirs. National Eutrophication Survey Working Paper No. 23. US EPA, Corvalis, OR.

United States Forest Service, 1990. Resource Pricing and Valuation Procedures for the Recommended RPA Program. USFS, Washington, D.C.

United State Water Resources Council, 1983. Principles and Guidelines for Economic Evaluations of Land and Water Resources. WA, D.C.:USGPO.

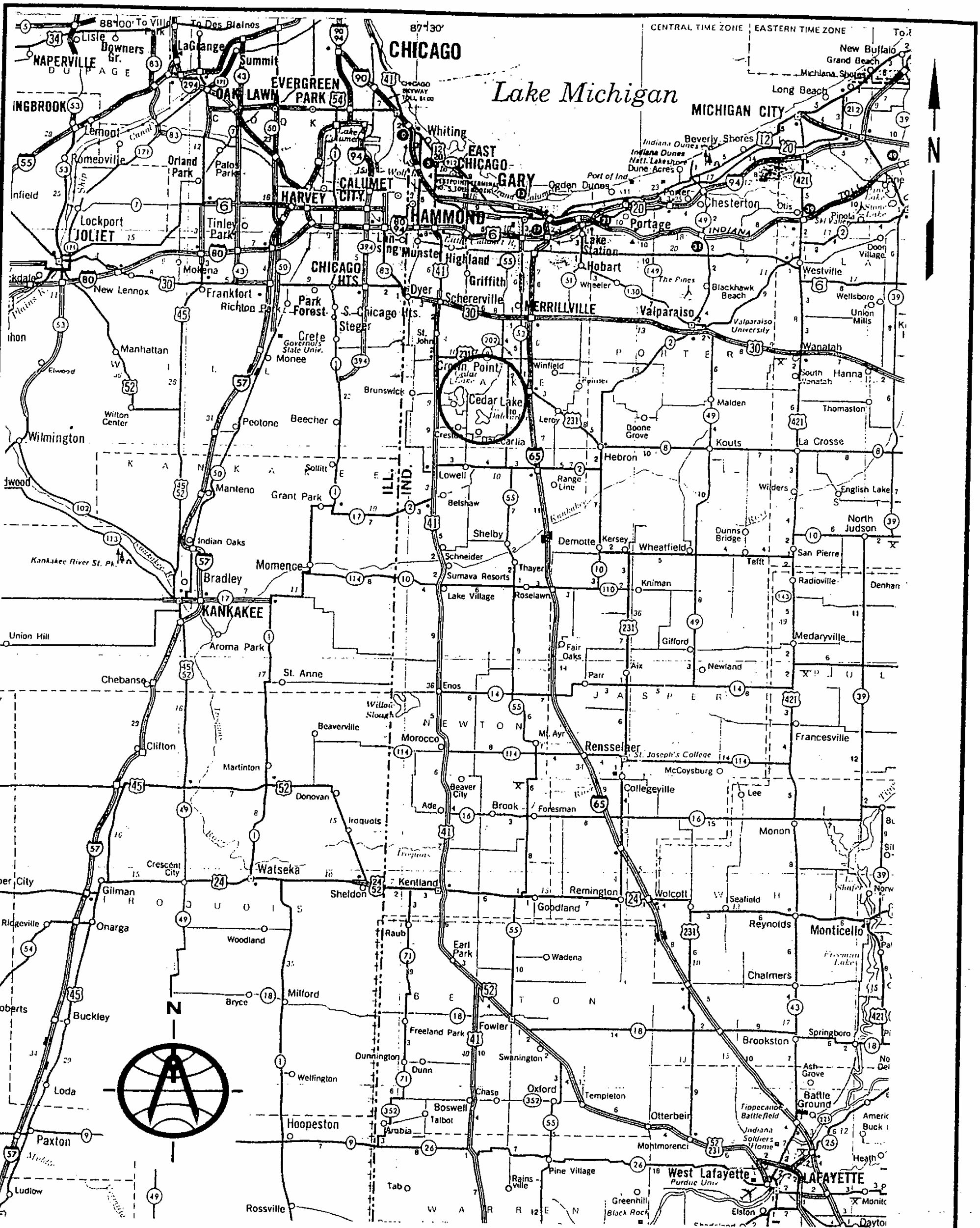
Walsh, R., 1984. Recreation Economic Decisions. Ft. Collins, Colorado State University, Venture Publishing (Revised with J. Loomis, 1996).

Personal communication with Cedar Lake Realtors and Associates (Owens Realty and Wright Realty, Cedar Lake), September 1998; review of property listings provided by the Northwest Indiana Realtors Association and real estate guides; review of real estate internet sites.

Personal communication with Cedar Lake Marina Owners/Operators, La Tulip Harbor, Pinecrest Marina, Yacht Club, and data provided from North Park Welcome Center, Cedar Lake,

August-September 1998.

FIGURES



Scale 0 2000 Feet

Figure 1

GENERAL LOCATION MAP

CEDAR LAKE DREDGE FEASIBILITY STUDY

Cedar Lake, Indiana

HARZA Consulting Engineers and Scientists

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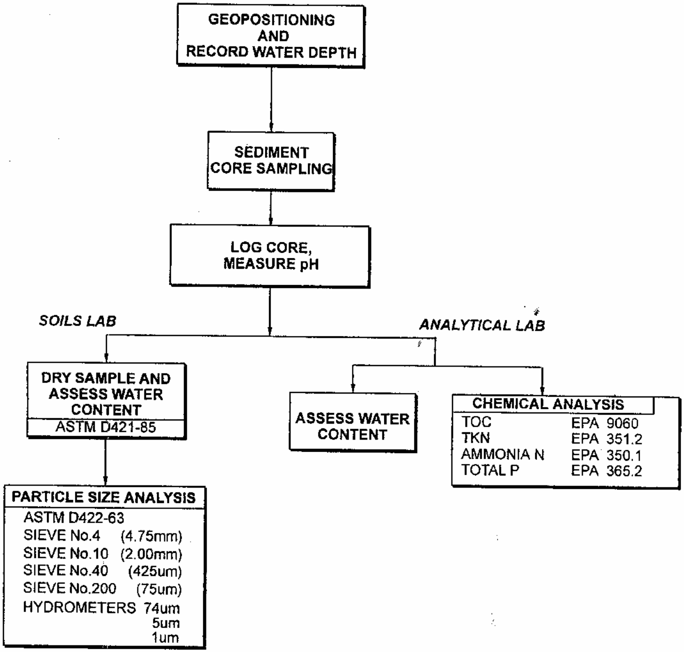

Figure 2
SEDIMENT COLLECTION AND ANALYSIS
CEDAR LAKE DREDGE FEASIBILITY STUDY
Cedar Lake, Indiana

HARZA *Consulting Engineers and Scientist*

LEGEND:

● Sediment Sample Location

■ E. Coli Sediment Sample Location

HARZA Consulting Engineers and Scientists

Figure 3

SEDIMENT SAMPLE LOCATION

CEDAR LAKE DREDGE FEASIBILITY STUDY

Cedar Lake, Indiana

Figure 4
PHOSPHORUS ISOPLETH MAP
CEDAR LAKE DREDGE FEASIBILITY STUDY
Cedar Lake, Indiana

HARZA *Consulting Engineers and Scientists*

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Figure 5
TOTAL KJELDHAL NITROGEN (TKN) ISOPLETH MAP
CEDAR LAKE DREDGE FEASIBILITY STUDY
Cedar Lake, Indiana

HARZA *Consulting Engineers and Scientists*

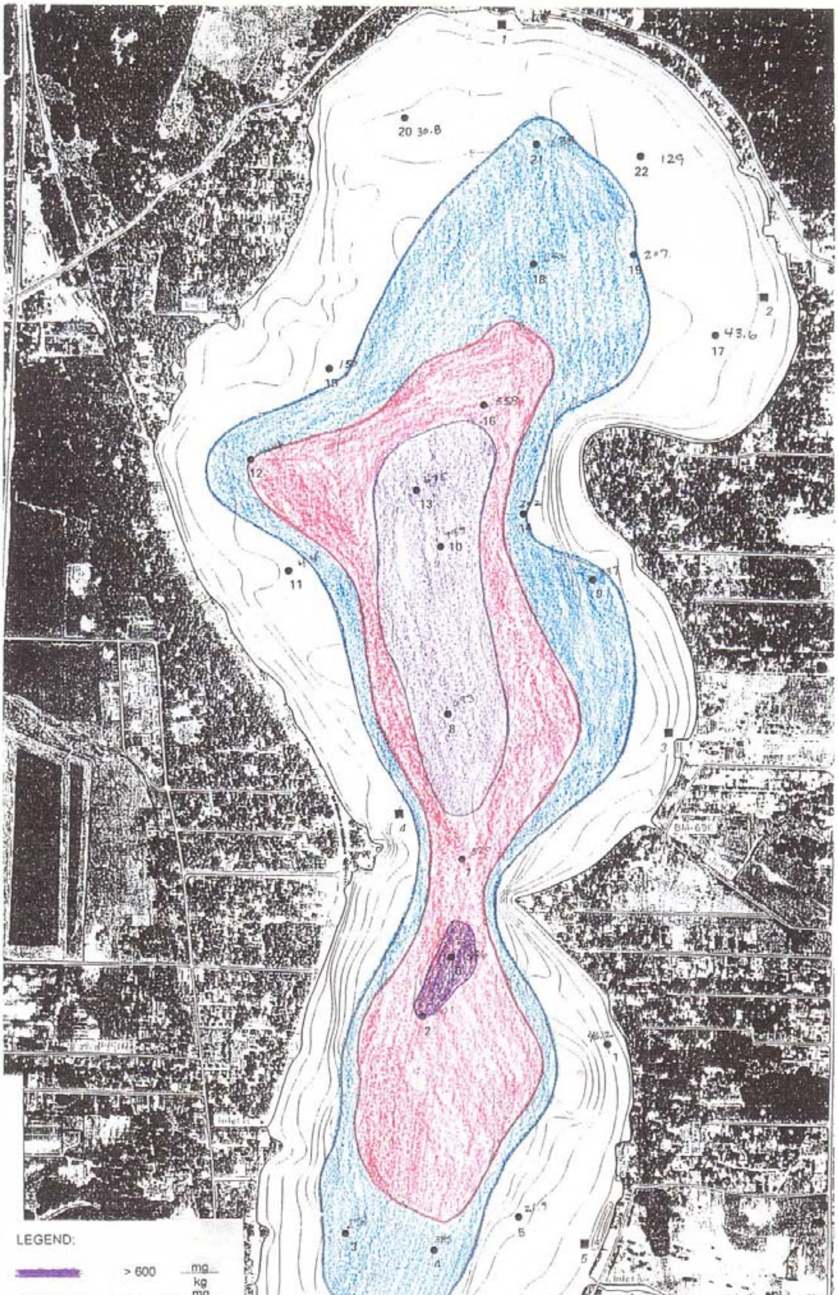

Figure 6
AMMONIA NITROGEN ISOPLETH MAP
CEDAR LAKE DREDGE FEASIBILITY STUDY
Cedar Lake, Indiana

HARZA *Consulting Engineers and Scientists*

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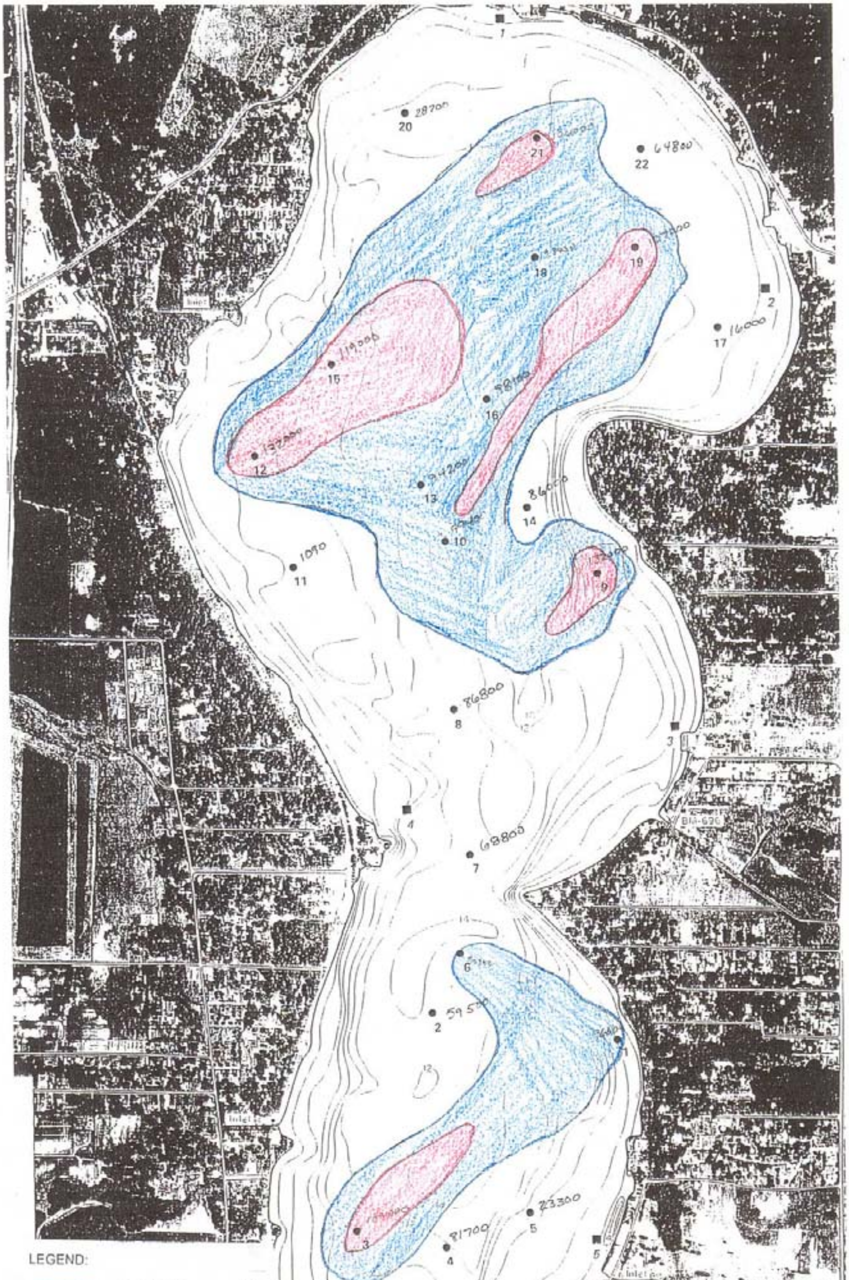

Figure 7
TOTAL ORGANIC CARBON ISOPLETH MAP
CEDAR LAKE DREDGE FEASIBILITY STUDY
Cedar Lake, Indiana

HARZA *Consulting Engineers and Scientists*

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Figure 8

PERCENT FINES ISOPLETH MAP

CEDAR LAKE DREDGE FEASIBILITY STUDY

Cedar Lake, Indiana

HARZA *Consulting Engineers and Scientists*

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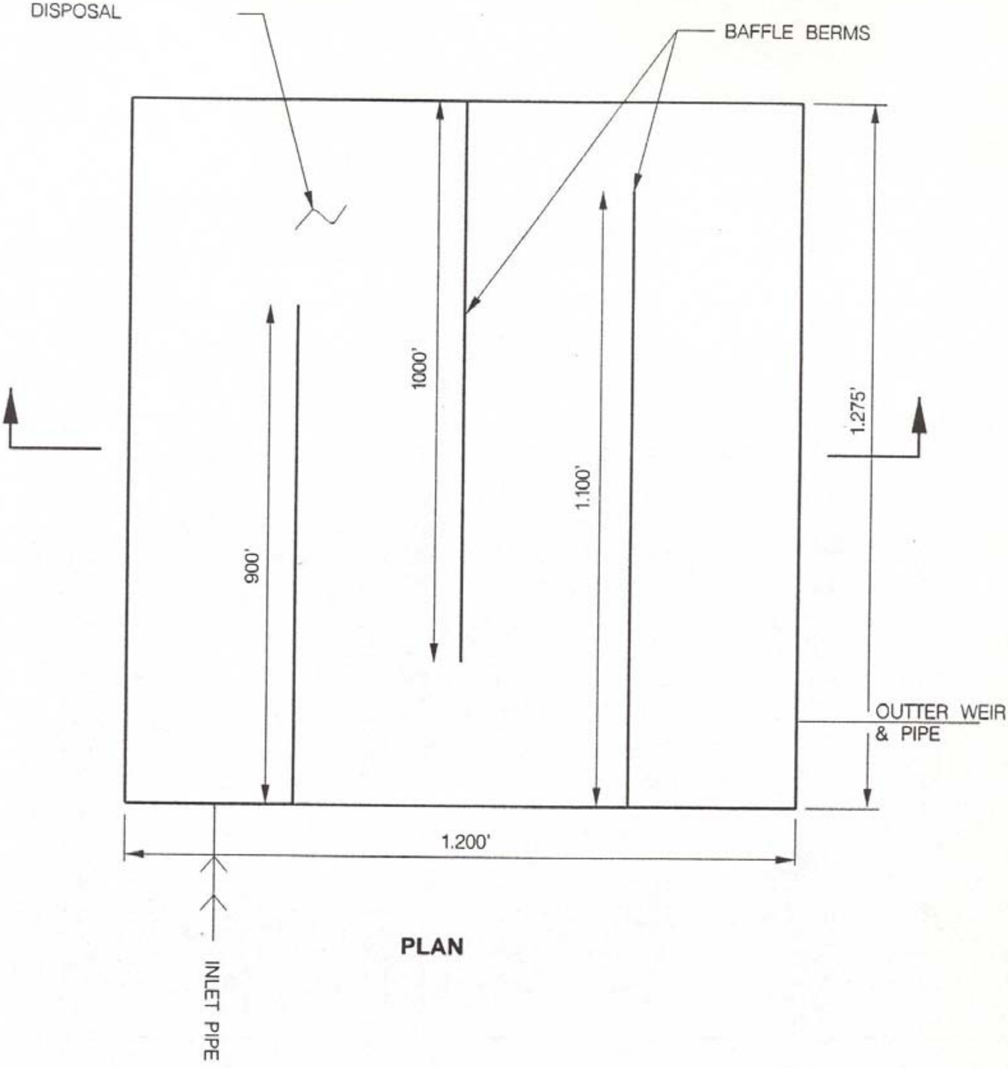
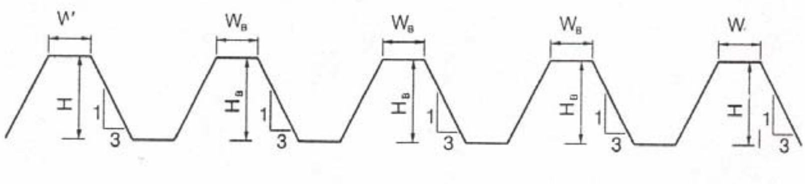


PLAN



PROFILE

NOT TO SCALE

HARZA Consulting Engineers and Scientists

Figure 9

CASE I: CONCEPTUAL CONFINED DISPOSAL FACILITY DESIGN

(PLAN & PROFILE VIEW)

Cedar Lake, Indiana

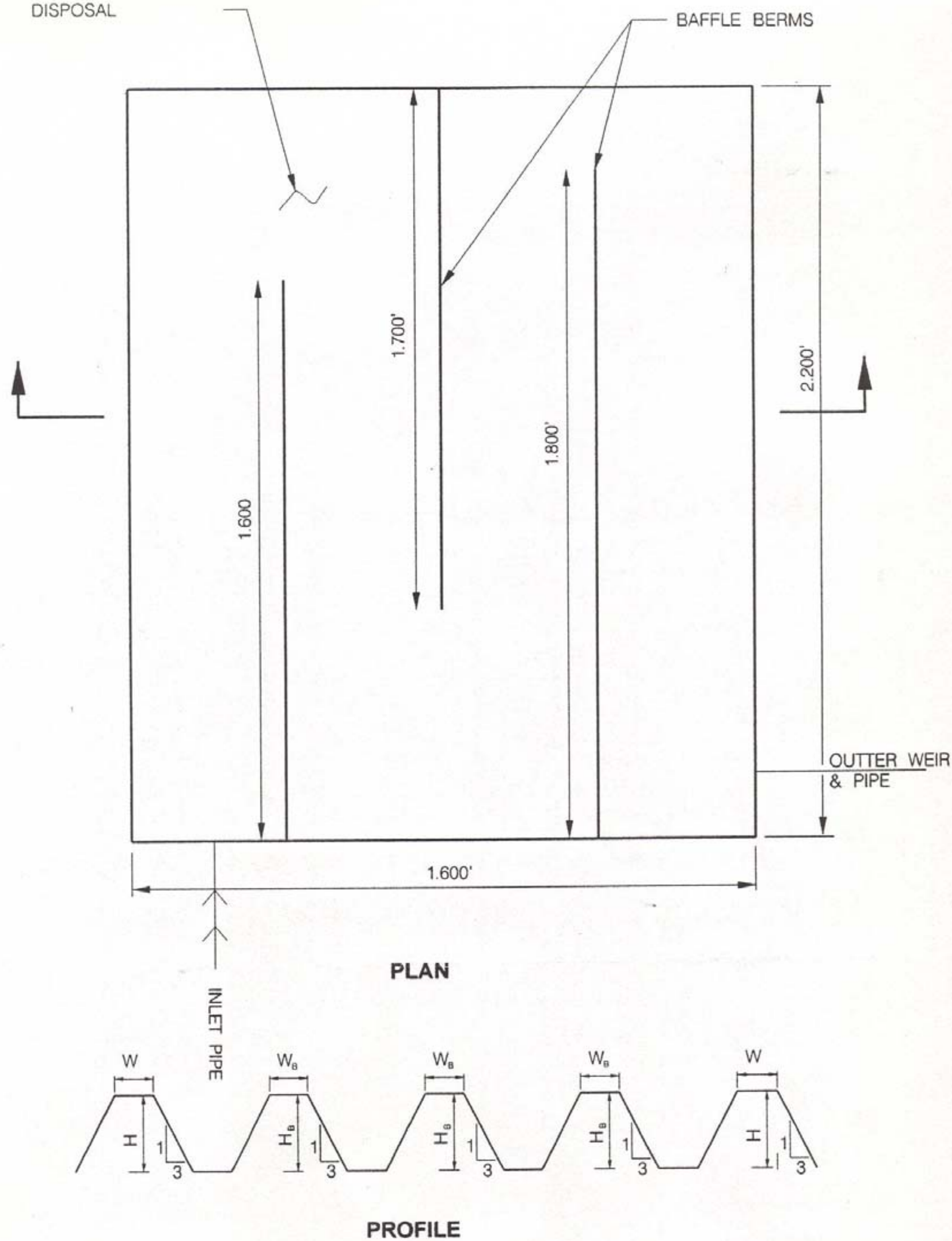


Figure 10

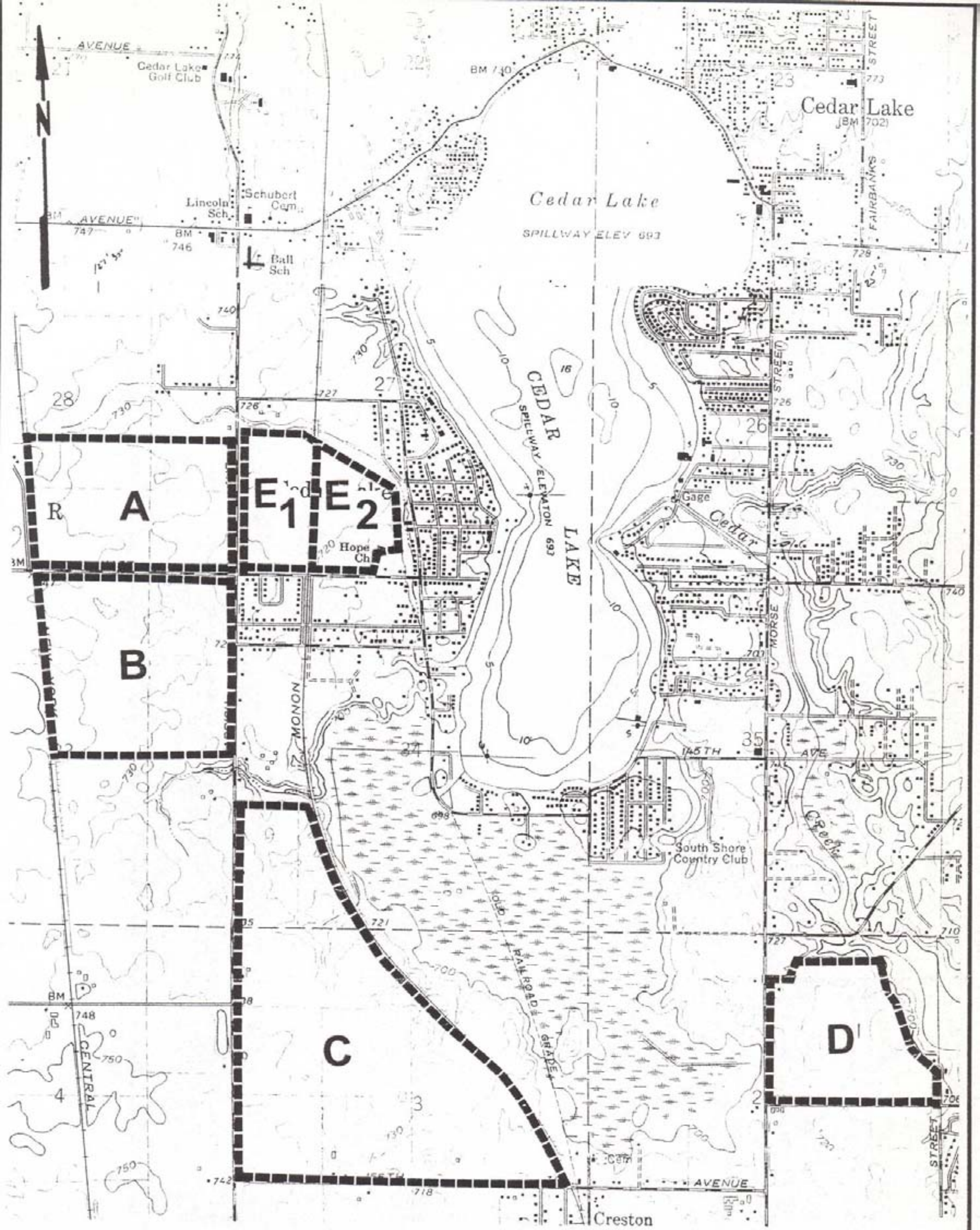
CASE II: CONCEPTUAL CONFINED DISPOSAL FACILITY DESIGN

(PLAN & PROFILE VIEW)

Cedar Lake, Indiana

NOT TO SCALE

HARZA *Consulting Engineers and Scientists*



Scale 0 1000 Feet

HARZA Consulting Engineers and Scientists

Figure 11

CONFINED DISPOSAL FACILITY LOCATIONS

CEDAR LAKE DREDGE FEASIBILITY STUDY

Cedar Lake, Indiana

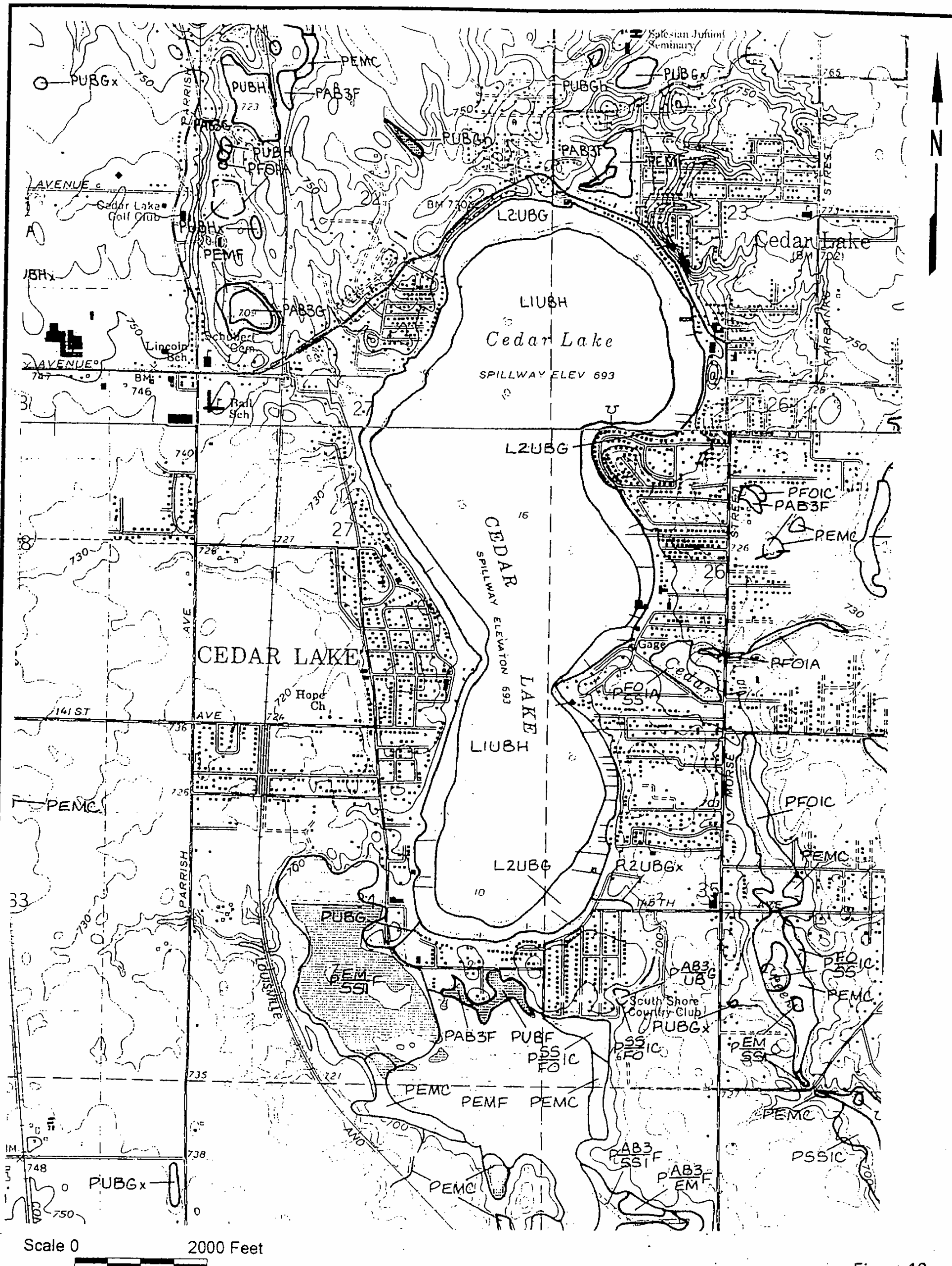


Figure 12

NATIONAL WETLANDS INVENTORY MAP

CEDAR LAKE DREDGE FEASIBILITY STUDY

Cedar Lake, Indiana

HARZA Consulting Engineers and Scientists

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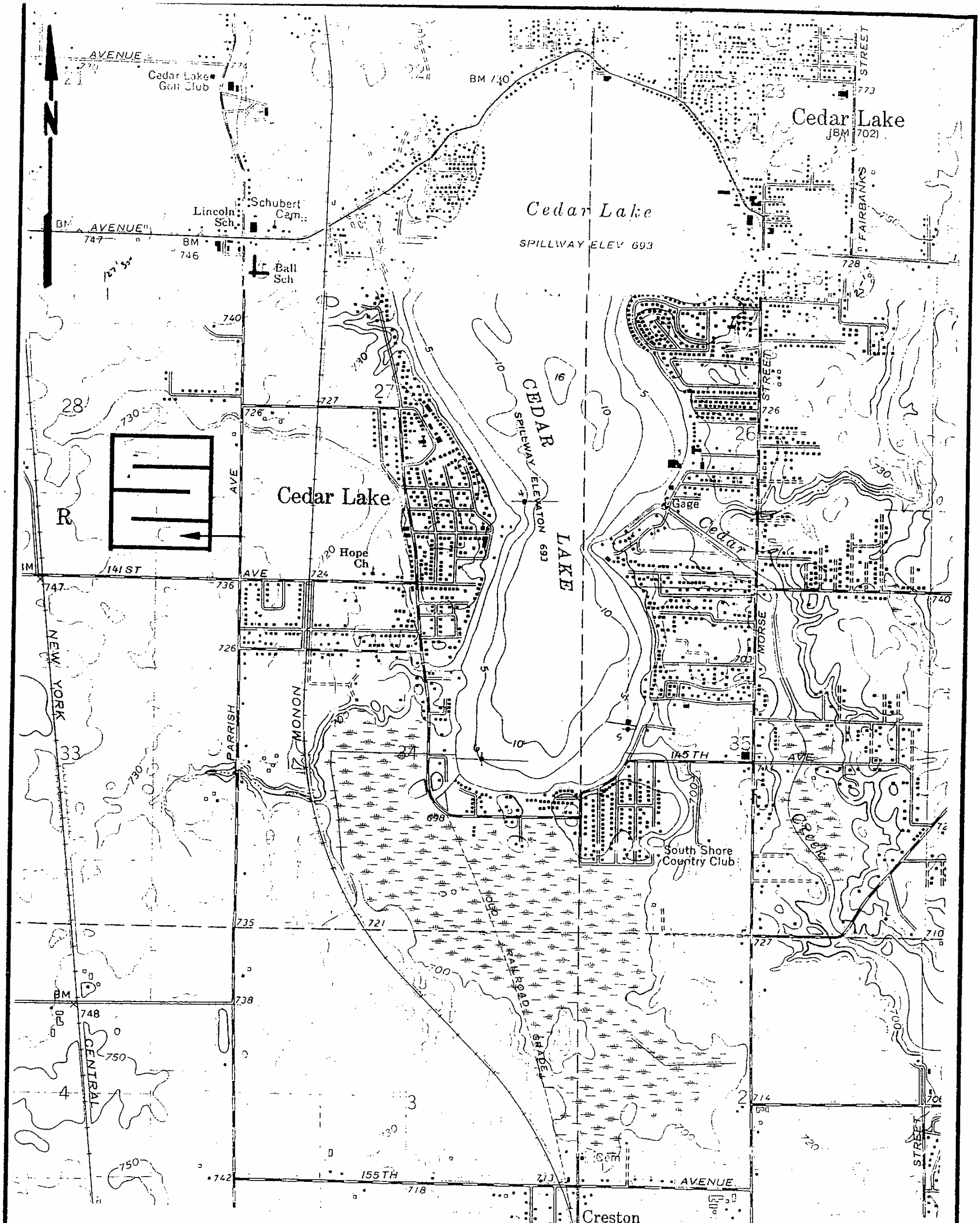

Scale 0 1000 Feet

Figure 13

RECOMMENDED CONFINED DISPOSAL FACILITY LOCATION

CEDAR LAKE DREDGE FEASIBILITY STUDY

Cedar Lake, Indiana

HARZA *Consulting Engineers and Scientists*

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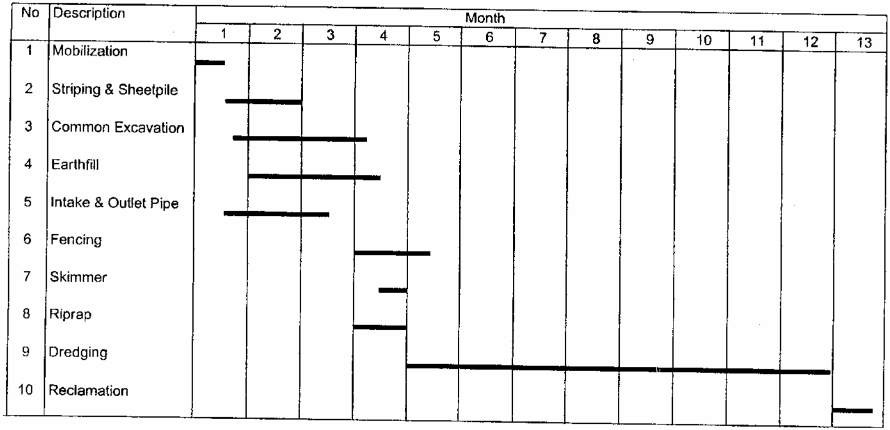

Figure 14

CASE I: DREDGING SCHEDULE

CEDAR LAKE DREDGE FEASIBILITY STUDY

Cedar Lake, Indiana

HARZA *Consulting Engineers and Scientists*

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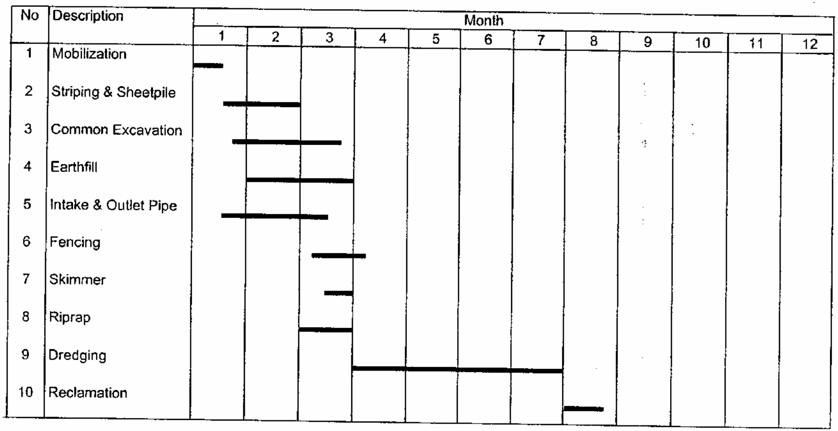

HARZA *Consulting Engineers and Scientists*

Figure 15

CASE II: DREDGING SCHEDULE

CEDAR LAKE DREDGE FEASIBILITY STUDY

Cedar Lake, Indiana

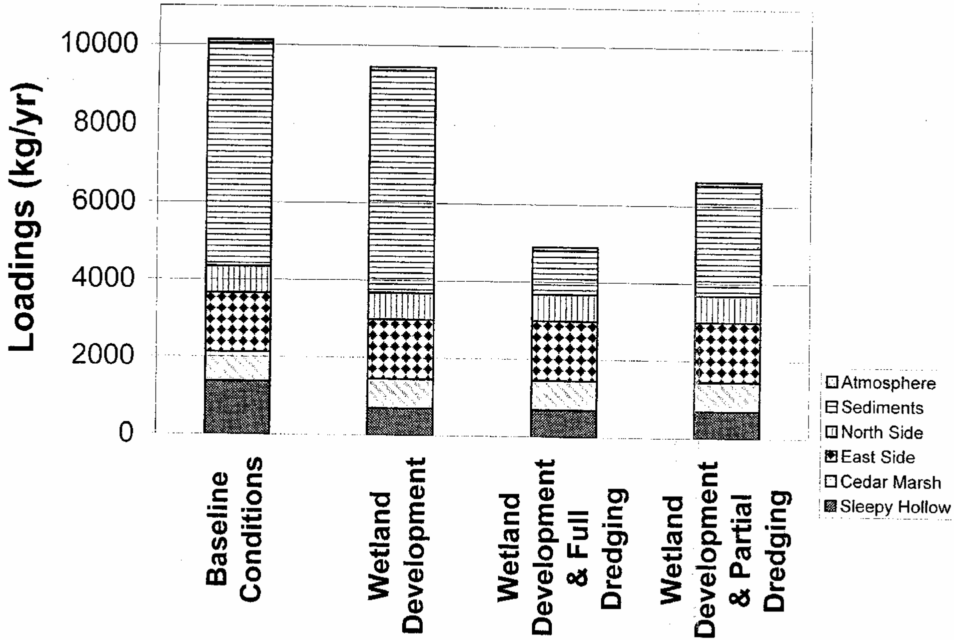

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Figure 16
EXISTING AND POTENTIAL PHOSPHORUS BUDGETS
CEDAR LAKE DREDGE FEASIBILITY STUDY
Cedar Lake, Indiana

APPENDICES

APPENDIX 1

ARDL Inc. applied research & development laboratory

CHEMISTRY · BIOLOGY · PHYSIOLOGY
ENGINEERING · ENVIRONMENTAL ANALYSIS

5 August 1998

Mr. Doug Mulvey
Harza Environmental Services
Sears Tower
233 South Wacker
Chicago, IL 60606

RE: ARDL Report 5123
Site: Cedar Lake
Project #: 9070BA

Dear Mr. Mulvey:

Enclosed please find one (1) copy of ARDL's report for analysis of samples received on 7/03/98 from the referenced site. The report format consists of sample results with QC backup.

If there are any questions concerning this data package, or if additional information is required, please contact the undersigned at (618) 244-3235.

Thank you.

Sincerely yours,

Daniel J. Gillespie
Technical Services Manager

DJG/jcm

Enclosure

ARDL REPORT NO. 5123
HARZA ENVIRONMENTAL SERVICES
CEDAR LAKE
PROJECT NO. 9070BA

PCB-8081

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 07/23/1998

Project Name: CEADAR LAKE, IN Analysis: PCB'S
Project No.: 9070BA Analytical Method: 8080A
Prep Method: 3550A

Field ID:	SS03	ARDL Lab No.:	005123-05
Desc/Location:	SS03	Lab Filename:	
Sample Date:	06/30/1998	Received Date:	07/03/1998
Sample Time:	1545	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3216
% Moisture:	78.9	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	26.3	156	ND		UG/KG	1
AROCLOR 1221	43	318	ND		UG/KG	1
AROCLOR 1232	25	156	ND		UG/KG	1
AROCLOR 1242	26.3	156	ND		UG/KG	1
AROCLOR 1248	26.1	156	ND		UG/KG	1
AROCLOR 1254	25.6	156	ND		UG/KG	1
AROCLOR 1260	26	156	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	79%
TETRACHLORO-m-XYLENE	3-137	79%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 07/23/1998

Project Name:	CEADAR LAKE, IN	Analysis:	PCB'S
Project No.:	9070BA	Analytical Method:	8080A
		Prep Method:	3550A

Field ID:	SS07	ARDL Lab No.:	005123-07
Desc/Location:	SS07	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	1100	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3216
% Moisture:	75.7	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	22.8	136	ND		UG/KG	1
AROCLOR 1221	37.4	276	ND		UG/KG	1
AROCLOR 1232	21.7	136	ND		UG/KG	1
AROCLOR 1242	22.8	136	ND		UG/KG	1
AROCLOR 1248	22.6	136	ND		UG/KG	1
AROCLOR 1254	22.2	136	ND		UG/KG	1
AROCLOR 1260	22.6	136	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	71%
TETRACHLORO-m-XYLENE	3-137	66%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 07/23/1998

Project Name: CEADAR LAKE, IN
Project No.: 9070BA
Analysis: PCB'S
Analytical Method: 8080A
Prep Method: 3550A

Field ID:	SS05	ARDL Lab No.:	005123-08
Desc/Location:	SS05	Lab Filename:	
Sample Date:	06/30/1998	Received Date:	07/03/1998
Sample Time:	1645	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/16/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3216
% Moisture:	20.9	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	7	41.7	ND		UG/KG	1
AROCLOR 1221	11.5	84.7	ND		UG/KG	1
AROCLOR 1232	6.7	41.7	ND		UG/KG	1
AROCLOR 1242	7	41.7	ND		UG/KG	1
AROCLOR 1248	7	41.7	ND		UG/KG	1
AROCLOR 1254	6.8	41.7	ND		UG/KG	1
AROCLOR 1260	6.9	41.7	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	56%
TETRACHLORO-m-XYLENE	3-137	45%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 07/23/1998

Project Name:	CEADAR LAKE, IN	Analysis:	PCB'S
Project No.:	9070BA	Analytical Method:	8080A
		Prep Method:	3550A

Field ID:	SS20	ARDL Lab No.:	005123-09
Desc/Location:	SS20	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	0830	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/16/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3216
% Moisture:	21.5	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	7.1	42.0	ND		UG/KG	1
AROCLOR 1221	11.6	85.4	ND		UG/KG	1
AROCLOR 1232	6.7	42.0	ND		UG/KG	1
AROCLOR 1242	7.1	42.0	ND		UG/KG	1
AROCLOR 1248	7	42.0	ND		UG/KG	1
AROCLOR 1254	6.9	42.0	ND		UG/KG	1
AROCLOR 1260	7	42.0	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	66%
TETRACHLORO-m-XYLENE	3-137	53%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 07/23/1998

Project Name:	CEADAR LAKE, IN	Analysis:	PCB'S
Project No.:	9070BA	Analytical Method:	8080A
		Prep Method:	3550A

Field ID:	SS22	ARDL Lab No.:	005123-10
Desc/Location:	SS22	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	0830	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3216
% Moisture:	69.6	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	18.3	109	ND		UG/KG	1
AROCLOR 1221	29.9	220	ND		UG/KG	1
AROCLOR 1232	17.4	109	ND		UG/KG	1
AROCLOR 1242	18.3	109	ND		UG/KG	1
AROCLOR 1248	18.1	109	ND		UG/KG	1
AROCLOR 1254	17.8	109	ND		UG/KG	1
AROCLOR 1260	18	109	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	73%
TETRACHLORO-m-XYLENE	3-137	59%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

METHOD BLANK REPORT
ARDL, Inc., Mt. Vernon Airport
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 07/23/1998

Project Name: CEADAR LAKE, IN
Project No.: 9070BA
Analysis: PCB'S
Analytical Method: 8080A
Prep Method: 3550A

Field ID:	NA	ARDL Lab No.:	005123-05B1
Desc/Location:	NA	Lab Filename:	
Sample Date:	NA	Received Date:	NA
Sample Time:	NA	Prep. Date:	07/14/1998
Matrix:	QC Material	Analysis Date:	07/16/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3216
% Moisture:	NA	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units
AROCLOR 1016	5.55	33.0	ND		UG/KG
AROCLOR 1221	9.08	67.0	ND		UG/KG
AROCLOR 1232	5.28	33.0	ND		UG/KG
AROCLOR 1242	5.55	33.0	ND		UG/KG
AROCLOR 1248	5.5	33.0	ND		UG/KG
AROCLOR 1254	5.4	33.0	ND		UG/KG
AROCLOR 1260	5.48	33.0	ND		UG/KG

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	87%
TETRACHLORO-m-XYLENE	3-137	74%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

BLANK SPIKE/SPIKE DUPLICATE REPORT

ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 07/23/1998

Project Name: CEADAR LAKE, IN Analysis: PCB'S Analytical Method: 8080A
Project No.: 9070BA Prep Method: 3550A

Matrix: QC Material QC Batch: B3216 Prep. Date: 07/14/1998
Amount Used: 30 g Level: LOW Analysis Date: 07/17/1998

Parameter	Spike Result	Spike Level	Spike % Rec	Duplicate Result	Duplicate Level	Duplicate % Rec	Recovery Limits	RPD	RPD Limit
AROCLOR 1260	228	333	68	--	--	--	50-150	--	--

SURROGATE RECOVERIES:	Spike %R	Duplicate %R	%R Limits
DECACHLOROBIPHENYL	73.3	--	22-133
TETRACHLORO-m-XYLENE	66.1	--	3-137

'*' indicates a recovery outside of standard limits.
Spike Blanks for 005123-05, PCB'S

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 07/23/1998

Project Name: CEADAR LAKE, IN Analysis: PCB'S
Project No.: 9070BA Analytical Method: 8080A
Prep Method: 3550A

Field ID:	NA	ARDL Lab No.:	005123-05K1
Desc/Location:	NA	Lab Filename:	
Sample Date:	NA	Received Date:	NA
Sample Time:	NA	Prep. Date:	07/14/1998
Matrix:	QC Material	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3216
% Moisture:	NA	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units
AROCLOR 1016	5.55	33	ND		UG/KG
AROCLOR 1221	9.08	67	ND		UG/KG
AROCLOR 1232	5.28	33	ND		UG/KG
AROCLOR 1242	5.55	33	ND		UG/KG
AROCLOR 1248	5.5	33	ND		UG/KG
AROCLOR 1254	5.4	33	ND		UG/KG
AROCLOR 1260	5.48	33	228		UG/KG

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	73%
TETRACHLORO-m-XYLENE	3-137	66%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

INORGANICS

INORGANIC ANALYSIS DATA PACKAGE

HARZA Environmental Services, Inc

Date: 08/11/98
ARDL Report No.: 5123

Lab Name: ARDL, Inc.
Samples Received at ARDL: 07/03/98
Project Name: Cedar Lake

CASE NARRATIVE

Sample ID No.	Date Collected	Lab ID No.	Analysis Requested
SS02	06/30/98	5123-01	Other Inorganics(1)
SS01	06/30/98	5123-02	Other Inorganics(1)
SS06	07/01/98	5123-03	Other Inorganics(1)
SS04	06/30/98	5123-04	Other Inorganics(1)
SS03	06/30/98	5123-05	Other Inorganics(1)
SS19	07/01/98	5123-06	Other Inorganics(1)
SS07	07/01/98	5123-07	Other Inorganics(1)
SS05	06/30/98	5123-08	Other Inorganics(1)
SS20	07/01/98	5123-09	Other Inorganics(1)
SS22	07/01/98	5123-10	Other Inorganics(1)
SS18	07/01/98	5123-11	Other Inorganics(1)

(1) Including ammonia-N, sieve analysis, TKN, TOC, total phosphorus and total solids.

The quality control data are summarized as follows:

LABORATORY CONTROL SAMPLES

Percent recovery of all LCS analyses were within control limits.

PREPARATION BLANKS

Results of all preparation blanks were within acceptable limits.

MATRIX SPIKES

Percent recovery of all matrix spikes and matrix spike duplicates except 1 of 2 for total phosphorus were within control limits. The sample result for TOC was greater than 4 times the spike amount; therefore, percent recovery is not considered.

DUPLICATES

RPD on all duplicate analyses were within control limits.
All duplicate analyses are reported as MS/MSD except total solids which is reported as sample/duplicate.

INORGANIC ANALYSIS DATA PACKAGE

HARZA Environmental Services, Inc

Date: 08/11/98
ARDL Report No.: 5123

Lab Name: ARDL, Inc.
Samples Received at ARDL: 07/03/98
Project Name: Cedar Lake

CASE NARRATIVE

Release of the data contained in this package has been authorized by the Technical Services Manager or his designee as verified by the following signature.

Daniel J. Gillespie

Daniel J. Gillespie
Technical Services Manager

5123

HARZA *Consulting Engineers and Scientists* № 254

SEARS TOWER • 233 South Wacker Drive • Chicago, Illinois 60606-6392 Tel: (312) 831-3800 • Fax: (312) 831-3999 • Telex: 25-3540

CHAIN OF CUSTODY RECORD

SITE: Cedar Lake

SAMPLER: (Signature) Doug Mulvey

PROJECT No. 9070BA

COOLER No. 160

PARAMETERS: Particle Size & Hydrometers, TOC, TKN, Ammonia N, Total P, PCB

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	No. OF CONTAINERS	Particle Size & Hydrometers	TOC	TKN	Ammonia N	Total P	PCB				REMARKS
SS02	6/30	1400		✓	SS02	1	✓	✓	✓	✓	✓	✓				Sediment, Cold
SS01	6/30	1310		✓	SS01	1	✓	✓	✓	✓	✓	✓				
SS06	7/1	1115		✓	SS06	1	✓	✓	✓	✓	✓	✓				
SS04	6/30	1615		✓	SS04	1	✓	✓	✓	✓	✓	✓				
SS03	6/30	1525		✓	SS03	1	✓	✓	✓	✓	✓	✓	✓			
SS19	7/1	945		✓	SS19	1	✓	✓	✓	✓	✓	✓				
SS07	7/1	1100		✓	SS07	1	✓	✓	✓	✓	✓	✓	✓			
SS05	6/30	1645		✓	SS05	1	✓	✓	✓	✓	✓	✓	✓			
SS20	7/1	830		✓	SS20	1	✓	✓	✓	✓	✓	✓	✓			
SS22	7/1	830		✓	SS22	1	✓	✓	✓	✓	✓	✓	✓			
SS18	7/1	1015		✓	SS18	1	✓	✓	✓	✓	✓	✓				
TEMP Blank																

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Douglas Mulvey	7/2/98	1300					

Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks:
			Sheila Kettle	7/3/98	1045	

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS02
Sampling Loc'n: SS02
Sampling Date: 06/30/1998
Sampling Time: 1400

ARDL No: 005123-01
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 75.6

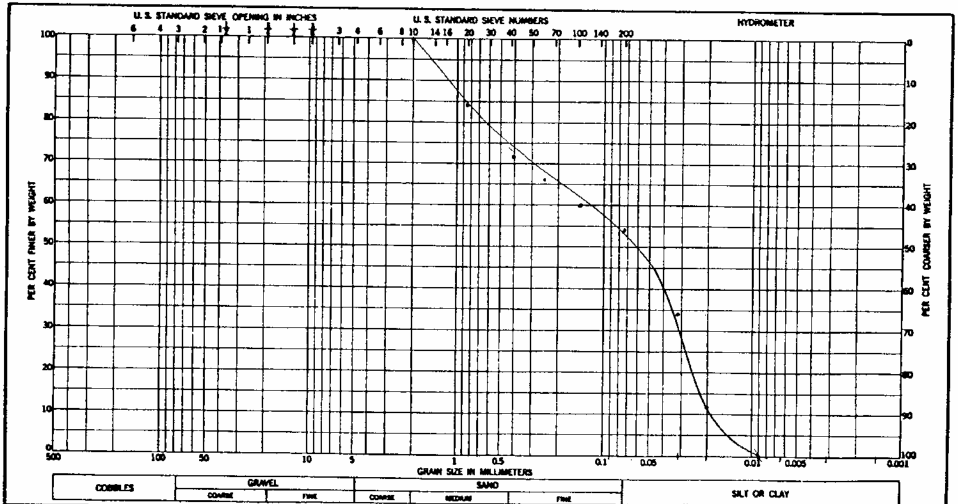
Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	512	7340	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	12.5	601	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	26.7	666	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	24.4	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	59500	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-1
Project Name	ARDL	Sample No.	12
Date	07/31/98	Test No.	

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	84.5	*	X	*	X	*	7.75
#40	*	72.2	*	X	*	X	*	13.89
#60	*	65.6	*	X	*	X	*	17.22
#100	*	60.0	*	X	*	X	*	19.99
#200	*	54.7	*	X	*	X	*	22.67
	*		*		*		*	
0.031	*	34.2	*	22	*	77	*	X
0.020	*	12.2	*	11	*	77	*	X
0.009	*	0.0	*	2	*	76	*	X
0.0063	*	0.0	*	1	*	76	*	X
0.0031	*	0.0	*	0.5	*	75	*	X
0.0014	*	0.0	*	0	*	75	*	X

HOLCOMB FOUNDATION ENGINEERING
P. O. Box 3344
Carbondale, IL 62902-3344



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-1						

Project	Laboratory Tests
	ARDL
	Mt. Vernon, Illinois
File No.	H-98207
Date	7-30-98

REPORT OF SOIL ANALYSIS

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN Analysis: Inorganics
Project No: 9070BA

Field ID: SS01 ARDL No: 005123-02
Sampling Loc'n: SS01 Received: 07/03/1998
Sampling Date: 06/30/1998 Matrix: SEDIMENT
Sampling Time: 1310 Moisture: 59.7

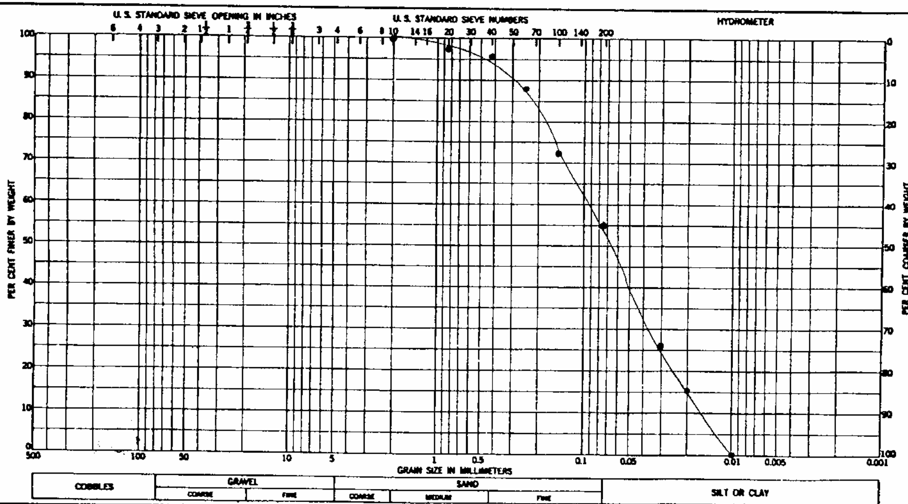
Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	270	2790	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	7	46.2	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	16.9	308	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	40.3	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	96600	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-2
Project Name	ARDL	Sample No.	14
Date	07/30/98	Test No.	

Grain Size	% Passing	Hydrometer	Temperature	Wt. Ret.
#10	100.0	X	X	0
#20	98.9	X	X	0.53
#40	96.7	X	X	1.65
#60	88.4	X	X	5.8
#100	73.8	X	X	13.08
#200	55.2	X	X	22.41
0.031	25.2	18	75	X
0.020	15.2	13	75	X
0.009	0.0	2.5	75	X
0.0063	0.0	2	75	X
0.0031	0.0	0.5	74	X
0.0014	0.0	0.5	73	X

HOLCOMB FOUNDATION ENGINEERING
P. O. Box 3344
Carbondale, IL 62902-3344



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-2						

REPORT OF SOIL ANALYSIS

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois

File No. H-98207

Date 7-30-98

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name:	CEDAR LAKE, IN	Analysis:	Inorganics
Project No:	9070BA		

Field ID:	SS06	ARDL No:	005123-03
Sampling Loc'n:	SS06	Received:	07/03/1998
Sampling Date:	07/01/1998	Matrix:	SEDIMENT
Sampling Time:	1115	Moisture:	79.1

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	598	7070	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	14.2	686	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	35.9	456	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	20.9	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	90300	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET   HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-3
Project Name	ARDL	Sample No.	15
Date	07/30/98	Test No.	

Grain Size	% Passing	Hydrometer	Temperature	Wt. Ret.
#10	100.0	X	X	0
#20	75.8	X	X	12.09
#40	59.2	X	X	20.38
#60	51.2	X	X	24.41
#100	44.5	X	X	27.74
#200	39.4	X	X	30.3
0.031	21.2	16	75	X
0.020	0.0	5	75	X
0.009	0.0	1.5	75	X
0.0063	0.0	1	75	X
0.0031	0.0	0	74	X
0.0014	0.0	0	73	X

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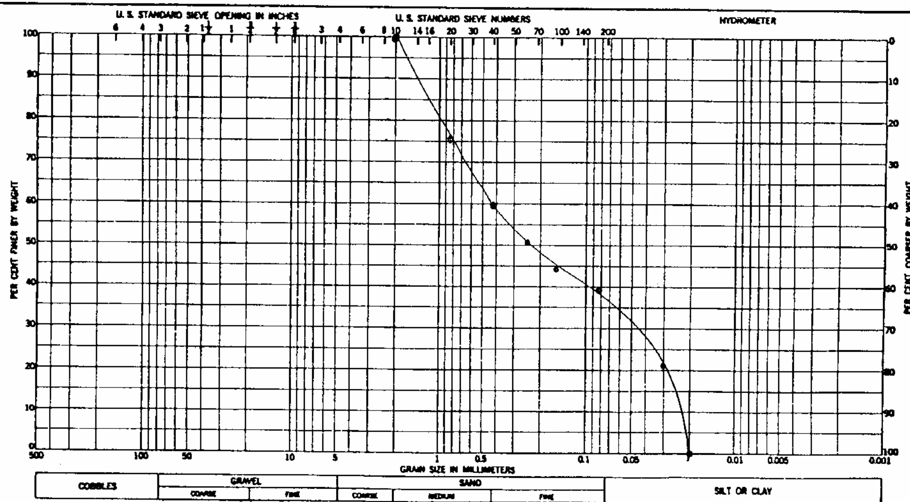
Carbondale, IL 62902-3344



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-3						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

REPORT OF SOIL ANALYSIS

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS04
Sampling Loc'n: SS04
Sampling Date: 06/30/1998
Sampling Time: 1615
ARDL No: 005123-04
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 78.9

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	515	7970	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	14.4	385	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	30.9	536	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	21.1	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	81700	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET   HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-4
Project Name	ARDL	Sample No.	13
Date	07/30/98	Test No.	

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	81.8	*	X	*	X	*	9.09
#40	*	64.9	*	X	*	X	*	17.57
#60	*	53.8	*	X	*	X	*	23.12
#100	*	45.6	*	X	*	X	*	27.22
#200	*	37.5	*	X	*	X	*	31.24
	*		*		*		*	
0.031	*	18.2	*	14.5	*	75	*	X
0.020	*	0.0	*	4	*	75	*	X
0.009	*	0.0	*	1	*	75	*	X
0.0063	*	0.0	*	1	*	75	*	X
0.0031	*	0.0	*	0	*	74	*	X
0.0014	*	0.0	*	0	*	73	*	X

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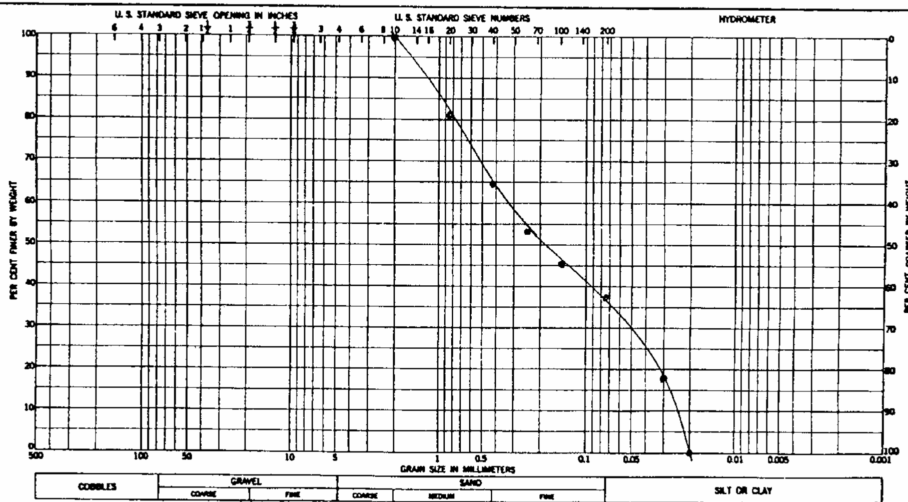

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-4						

Project	Laboratory Tests
	ARDL
	Mt. Vernon, Illinois
File No.	H-98207
Date	7-30-98

REPORT OF SOIL ANALYSIS

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name:	CEDAR LAKE, IN	Analysis:	Inorganics
Project No:	9070BA		

Field ID:	SS03	ARDL No:	005123-05
Sampling Loc'n:	SS03	Received:	07/03/1998
Sampling Date:	06/30/1998	Matrix:	SEDIMENT
Sampling Time:	1545	Moisture:	78.9

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	592	8580	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	14.1	298	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	32.3	464	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	21.1	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	109000	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-5
Project Name	ARDL	Sample No.	2
Date	07/31/98	Test No.	

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	80.7	*	X	*	X	*	9.63
#40	*	67.0	*	X	*	X	*	16.48
#60	*	59.1	*	X	*	X	*	20.44
#100	*	50.9	*	X	*	X	*	24.56
#200	*	41.8	*	X	*	X	*	29.11
	*		*		*		*	
0.031	*	23.2	*	16.5	*	77	*	X
0.020	*	0.0	*	3	*	77	*	X
0.009	*	0.0	*	1	*	76	*	X
0.0063	*	0.0	*	1	*	76	*	X
0.0031	*	0.0	*	0.5	*	75	*	X
0.0014	*	0.0	*	0	*	75	*	X

HOLCOMB FOUNDATION ENGINEERING
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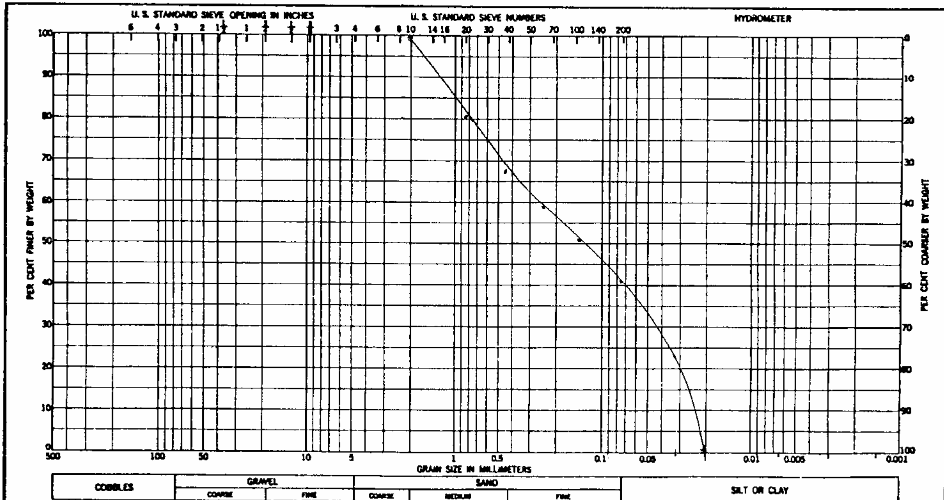

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-5						

Project	Laboratory Tests
	ARDL
	Mt. Vernon, Illinois
File No.	H-98207
Date	7-30-98

REPORT OF SOIL ANALYSIS

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name:	CEDAR LAKE, IN	Analysis:	Inorganics
Project No:	9070BA		

Field ID:	SS19	ARDL No:	005123-06
Sampling Loc'n:	SS19	Received:	07/03/1998
Sampling Date:	07/01/1998	Matrix:	SEDIMENT
Sampling Time:	0945	Moisture:	77.6

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	558	6480	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	13.1	207	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	33.5	468	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	22.4	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	107000	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-6
Project Name	ARDL	Sample No.	16
Date	07/31/98	Test No.	

Grain Size	% Passing	Hydrometer	Temperature	Wt. Ret.
#10	100.0	X	X	0
#20	94.5	X	X	2.76
#40	85.4	X	X	7.3
#60	76.0	X	X	12
#100	66.5	X	X	16.73
#200	54.9	X	X	22.56
0.031	27.2	18.5	77	X
0.020	0.2	5	77	X
0.009	0.0	1	76	X
0.0063	0.0	1	76	X
0.0031	0.0	0.5	75	X
0.0014	0.0	0	75	X

HOLCOMB FOUNDATION ENGINEERING
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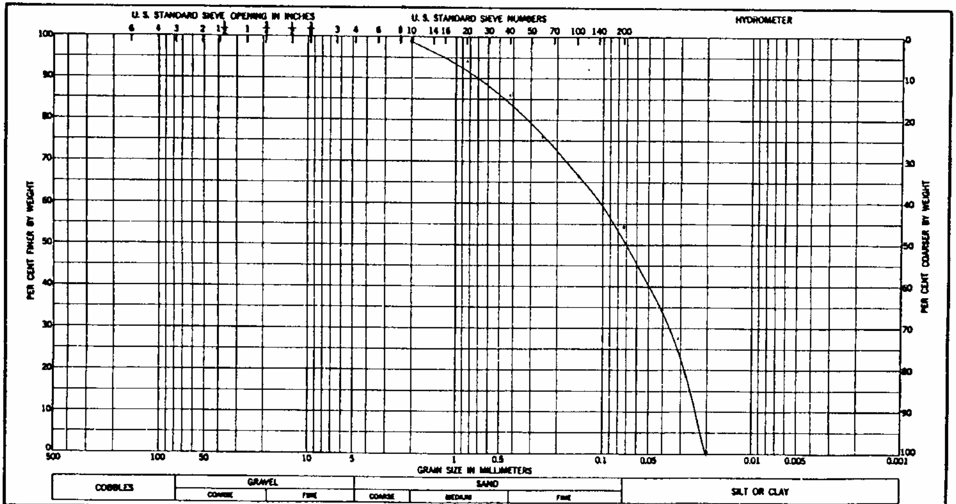

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-6						

REPORT OF SOIL ANALYSIS

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN Analysis: Inorganics
Project No: 9070BA

Field ID: SS07 ARDL No: 005123-07
Sampling Loc'n: SS07 Received: 07/03/1998
Sampling Date: 07/01/1998 Matrix: SEDIMENT
Sampling Time: 1100 Moisture: 75.7

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	490	7900	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	12.1	520	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	28.1	947	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	24.3	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	68800	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET   HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207		Boring No.	5123-7
Project Name	ARDL		Sample No.	13
Date	07/31/98		Test No.	

Grain Size	% Passing	Hydrometer	Temperature	Wt. Ret.
#10	100.0	X	X	0
#20	86.8	X	X	6.62
#40	74.9	X	X	12.54
#60	67.3	X	X	16.34
#100	61.3	X	X	19.34
#200	53.9	X	X	23.03
0.031	35.2	22.5	77	X
0.020	8.2	9	77	X
0.009	0.0	1.5	76	X
0.0063	0.0	1	76	X
0.0031	0.0	0.5	75	X
0.0014	0.0	0	75	X

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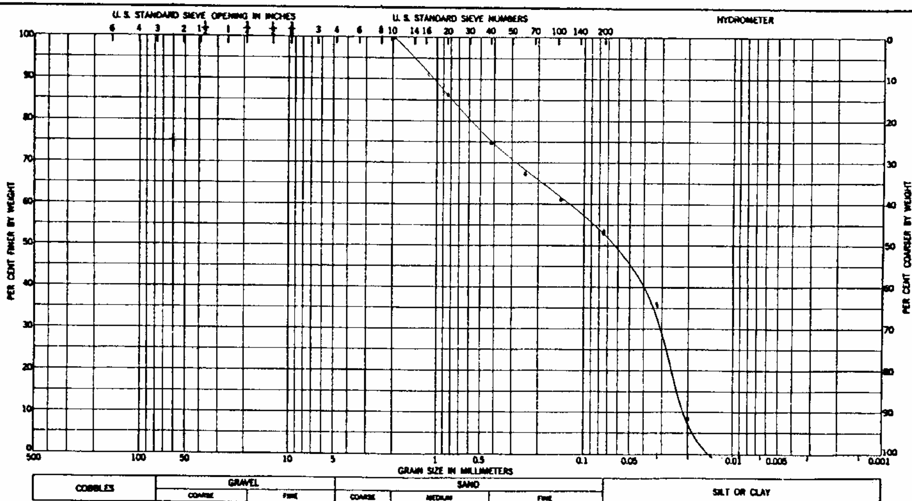

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-7						

REPORT OF SOIL ANALYSIS

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS05
Sampling Loc'n: SS05
Sampling Date: 06/30/1998
Sampling Time: 1645
ARDL No: 005123-08
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 20.9

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	31.6	412	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	3.5	21.9	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	9	221	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	79.1	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	23300	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-8
Project Name	ARDL	Sample No.	18
Date	07/30/98	Test No.	

Grain Size	% Passing	Hydrometer	Temperature	Wt. Ret.
#10	100.0	X	X	0
#20	96.2	X	X	1.9
#40	92.2	X	X	3.89
#60	73.3	X	X	13.34
#100	54.5	X	X	22.73
#200	48.0	X	X	25.99
0.031	39.2	25	75	X
0.020	27.2	19	75	X
0.009	18.2	14.5	75	X
0.0063	15.2	13	75	X
0.0031	0.0	2	74	X
0.0014	0.0	0	73	X

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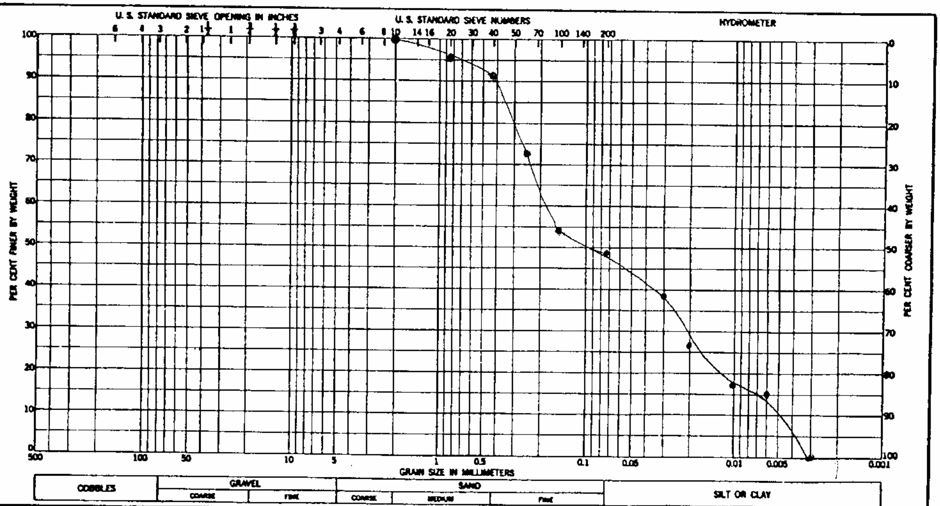

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-8						

Project: Laboratory Tests
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

REPORT OF SOIL ANALYSIS

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS20
Sampling Loc'n: SS20
Sampling Date: 07/01/1998
Sampling Time: 0830
ARDL No: 005123-09
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 21.5

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	26.5	324	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	3.6	30.8	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	9.6	250	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	78.5	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	28700	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-9
Project Name	ARDL	Sample No.	2
Date	07/30/98	Test No.	

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	94.0	*	X	*	X	*	2.98
#40	*	87.4	*	X	*	X	*	6.32
#60	*	75.8	*	X	*	X	*	12.08
#100	*	66.0	*	X	*	X	*	17.01
#200	*	62.5	*	X	*	X	*	18.73
	*		*		*		*	
0.031	*	43.2	*	27	*	75	*	X
0.020	*	39.2	*	25	*	75	*	X
0.009	*	25.2	*	18	*	75	*	X
0.0063	*	21.2	*	16	*	75	*	X
0.0031	*	8.8	*	10	*	74	*	X
0.0014	*	0.0	*	0	*	73	*	X

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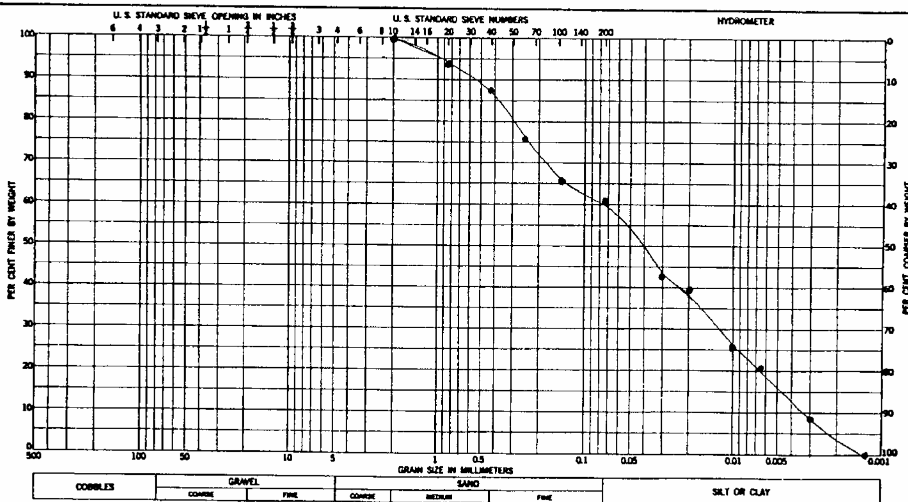

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-9						

REPORT OF SOIL ANALYSIS

Project	Laboratory Tests
	ARDL
	Mt. Vernon, Illinois
File No.	H-98207
Date	7-30-98

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS22
Sampling Loc'n: SS22
Sampling Date: 07/01/1998
Sampling Time: 0830

ARDL No: 005123-10
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 69.6

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	411	3400	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	9.9	129	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	21.5	363	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	30.4	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	64800	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-10
Project Name	ARDL	Sample No.	5
Date	07/30/98	Test No.	

Grain Size	% Passing	Hydrometer	Temperature	Wt. Ret.
#10	100.0	X	X	0
#20	99.5	X	X	0.26
#40	98.8	X	X	0.58
#60	95.8	X	X	2.1
#100	87.0	X	X	6.5
#200	65.7	X	X	17.15
0.031	32.2	21.5	75	X
0.020	1.2	6	75	X
0.009	0.0	1	75	X
0.0063	0.0	1	75	X
0.0031	0.0	0	73	X
0.0014	0.0	0	73	X

HOLCOMB FOUNDATION ENGINEERING
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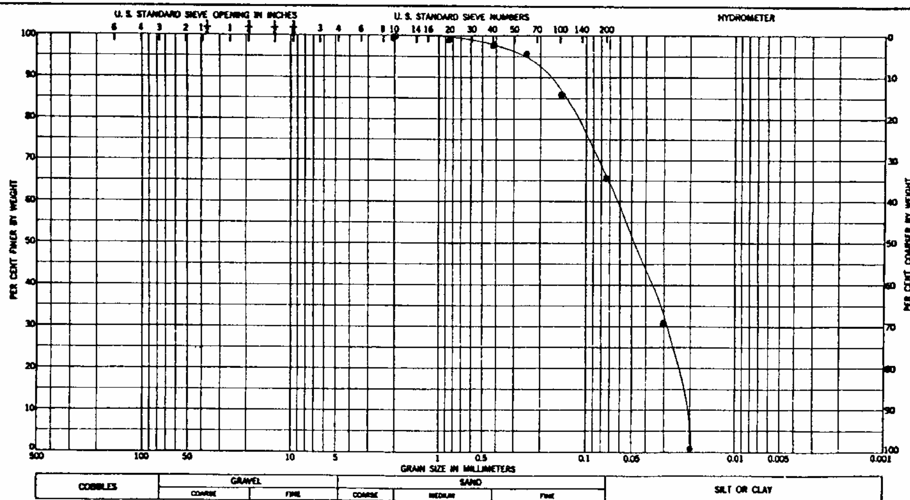

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-10						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois

File No. H-98207

Date 7-30-98

REPORT OF SOIL ANALYSIS

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name:	CEDAR LAKE, IN	Analysis:	Inorganics
Project No:	9070BA		

Field ID:	SS18	ARDL No:	005123-11
Sampling Loc'n:	SS18	Received:	07/03/1998
Sampling Date:	07/01/1998	Matrix:	SEDIMENT
Sampling Time:	1015	Moisture:	78.9

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	539	5900	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302
NITROGEN, AMMONIA	13	239	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303
PHOSPHORUS, TOTAL	32.3	1060	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	21.1	%	NONE	160.3	NA	07/07/98	08115304
TOTAL ORGANIC CARBON	25	93400	MG/KG	NONE	9060M	NA	07/27/98	08115300

HYDROMETER WORKSHEET HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-11
Project Name	ARDL	Sample No.	9
Date	07/30/98	Test No.	

Grain Size	% Passing	Hydrometer	Temperature	Wt. Ret.
#10	100.0	X	X	0
#20	85.0	X	X	7.52
#40	68.4	X	X	15.8
#60	56.8	X	X	21.61
#100	47.6	X	X	26.18
#200	39.1	X	X	30.43
0.031	19.2	15	75	X
0.020	0.0	4.5	75	X
0.009	0.0	1	75	X
0.0063	0.0	1	75	X
0.0031	0.0	0	73	X
0.0014	0.0	0	73	X

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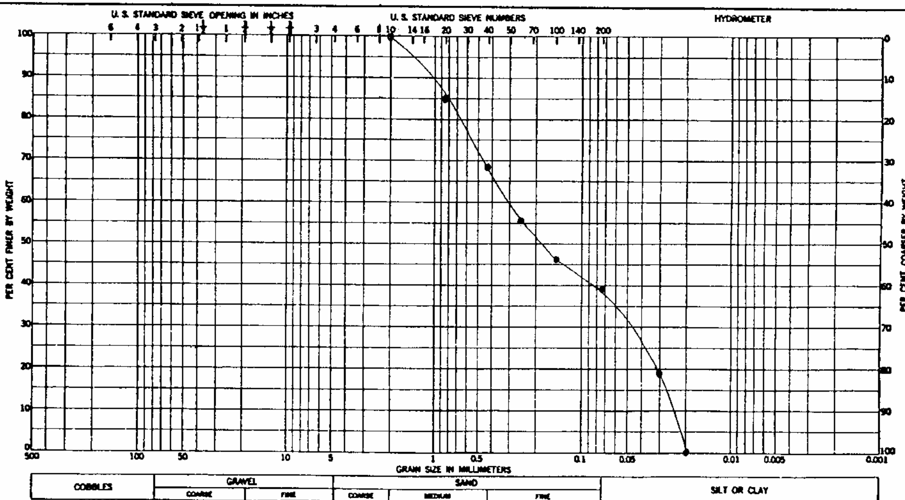

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-11						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois

File No. H-98207

Date 7-30-98

REPORT OF SOIL ANALYSIS

MATRIX SPIKE/SPIKE DUPLICATE REPORT

ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA

Analyte	Sample Matrix	Sample Result	MS Result	MS Level	MS % Rec	MSD Result	MSD Level	MSD % Rec	% Rec Limits	RPD	RPD Limit	Run	QC Lab Number
KJELDAHL NITROGEN	SEDIMENT	412	568	126	124	538	110	115	75-125	5	20	08115302	005123-08MS
NITROGEN, AMMONIA	SEDIMENT	21.9	109	110	79	119	107	91	75-125	9	20	08115303	005123-08MS
PHOSPHORUS, TOTAL	SEDIMENT	221	350	151	85	328	151	71 *	75-125	7	20	08115301	005123-08MS
TOTAL ORGANIC CARBON	SEDIMENT	64800	78200	4760	281 *	0	0	--	75-125	--	--	08115300	005123-10MS

NOTE: Any values tabulated above marked with an asterisk are outside of acceptable limits.

SAMPLE DUPLICATE REPORT

ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005123

Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN

Project No.: 9070BA

Analyte	Sample Conc'n	First Duplicate	Second Duplicate	Units	Percent Diff	Mean (Smp,D1,D2)	Analytical Run	QC Lab Number
SOLIDS, TOTAL	24.4	24.2	--	%	1	--	08115304	005123-01D1

HYDROMETER WORKSHEET HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	5123-1 (dup)
Project Name	ARDL	Sample No.	
Date	07/30/98	Test No.	

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	80.2	*	X	*	X	*	9.91
#40	*	66.2	*	X	*	X	*	16.9
#60	*	58.4	*	X	*	X	*	20.8
#100	*	51.7	*	X	*	X	*	24.13
#200	*	46.3	*	X	*	X	*	26.84
	*		*		*		*	
0.031	*	28.2	*	19.5	*	75	*	X
0.020	*	1.2	*	6	*	75	*	X
0.009	*	0.0	*	2	*	75	*	X
0.0063	*	0.0	*	2	*	75	*	X
0.0031	*	0.0	*	1	*	74	*	X
0.0014	*	0.0	*	0.5	*	73	*	X

HOLCOMB FOUNDATION ENGINEERING
P. O. Box 3344
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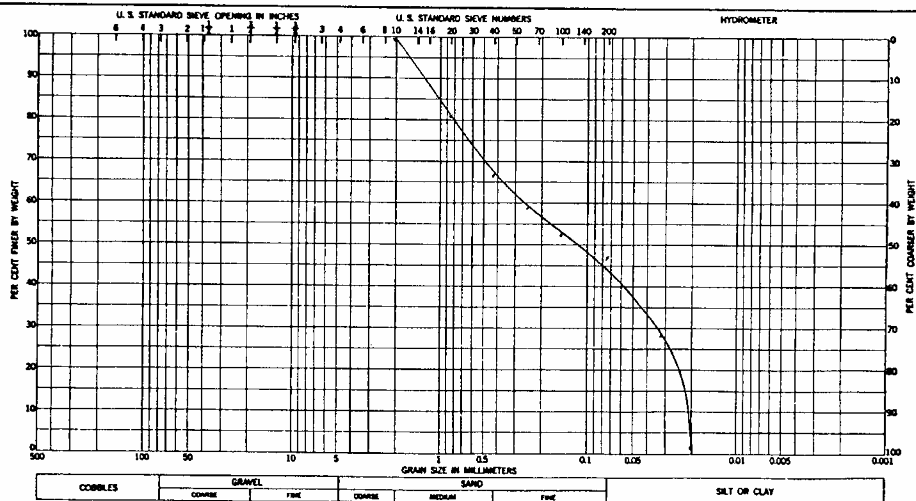

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5123-1 (Dup)						

Project Laboratory Testing
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

REPORT OF SOIL ANALYSIS

BLANK SUMMARY REPORT

ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA

Analyte	Detect Limit	Blank Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run	QC Lab Number
KJELDAHL NITROGEN	12.5	ND	MG/KG	351.2	351.2	07/22/98	07/23/98	08115302	005123-08B1
NITROGEN, AMMONIA	3	ND	MG/KG	350.1	350.1	07/20/98	07/21/98	08115303	005123-08B1
PHOSPHORUS, TOTAL	1.5	ND	MG/KG	365.2	365.2	07/22/98	07/23/98	08115301	005123-08B1
SOLIDS, TOTAL	1	ND	%	NONE	160.3	NA	07/07/98	08115304	005123-01B1
TOTAL ORGANIC CARBON	25	ND	MG/KG	NONE	9060M	NA	07/27/98	08115300	005123-10B1

LABORATORY CONTROL SAMPLE REPORT
ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005123 Report Date: 08/11/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA

Analyte	LCS 1 Result	LCS 1 Level	LCS 1 % Rec	LCS 2 Result	LCS 2 Level	LCS 2 % Rec	% Rec Limits	Mean % Rec	Analytical Run	QC Lab Number
KJELDAHL NITROGEN	0.99	1	99	--	--	--	80-120	--	08115302	005123-08C1
NITROGEN, AMMONIA	1	1	100	--	--	--	80-120	--	08115303	005123-08C1
PHOSPHORUS, TOTAL	0.66	0.67	99	--	--	--	80-120	--	08115301	005123-08C1
TOTAL ORGANIC CARBON	915	1000	92	--	--	--	80-120	--	08115300	005123-10C1

NOTE: Any values tabulated above marked with an asterisk are outside of acceptable limits.

CHAIN-OF-CUSTODY INFORMATION

5123

HARZA Consulting Engineers and Scientists

№ 254

SEARS TOWER • 233 South Wacker Drive • Chicago, Illinois 60606-6392 Tel: (312) 831-3800 • Fax: (312) 831-3999 • Telex: 25-3540

CHAIN OF CUSTODY RECORD

SITE: Cedar Lake

SAMPLER: (Signature) Doug Mulvey

PROJECT No. 9070BA

COOLER No. 160

PARAMETERS

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	No. OF CONTAINERS	Particle Size & Hydrometers	TOC	TKN	Ammonia N	Total P	PCB				REMARKS
SS02	6/30	1400		✓	SS02	1	✓	✓	✓	✓	✓	✓				Sediment, Cold
SS01	6/30	1310		✓	SS01	1	✓	✓	✓	✓	✓	✓				
SS06	7/1	1115		✓	SS06	1	✓	✓	✓	✓	✓	✓				
SS04	6/30	1615		✓	SS04	1	✓	✓	✓	✓	✓	✓				
SS03	6/30	1535		✓	SS03	1	2 ✓	✓	✓	✓	✓	✓	✓			
SS19	7/1	945		✓	SS19	1	✓	✓	✓	✓	✓	✓				
SS07	7/1	1100		✓	SS07	1	✓	✓	✓	✓	✓	✓	✓			
SS05	6/30	1645		✓	SS05	1	✓	✓	✓	✓	✓	✓	✓			
SS20	7/1	830		✓	SS20	1	✓	✓	✓	✓	✓	✓	✓			
SS22	7/1	830		✓	SS22	1	✓	✓	✓	✓	✓	✓	✓			
SS18	7/1	1015		✓	SS18	1	✓	✓	✓	✓	✓	✓				
Temp Blank																

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Douglas Mulvey	7/2/98	1300					

Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks:
			Sheila Kettler	7/3/98	1045	

COOLER RECEIPT REPORT
ARDL, INC.

ARDL #: 5123

Cooler # 160
Number of Coolers In Shipment: 2

Project:: Cedar Lake

Date Received: 7/3/98

A. **PRELIMINARY EXAMINATION PHASE:** Date cooler was opened: 7/6/98 (Signature) Sheila Kittle

1. Did cooler come with a shipping slip (airbill, etc.)? ..... YES NO
   If YES, enter carrier name and airbill number here: Fed Ex 804 640 331 656
2. Were custody seals on outside of cooler? ..... YES NO N/A
   How many and where? 2 front + back, Seal Date: 7/2/98, Seal Name: Doug Mulvey
3. Were custody seals unbroken and intact at the date and time of arrival? ..... YES NO N/A
4. Did you screen samples for radioactivity using a Geiger Counter? ..... YES NO
5. Were custody papers sealed in a plastic bag and taped inside to the lid? ..... YES NO
6. Were custody papers filled out properly (ink, signed, etc.)? ..... YES NO N/A
7. Were custody papers signed in appropriate place by ARDL personnel? ..... YES NO N/A
8. Was project identifiable from custody papers? If YES, enter project name at the top of this form ..... YES NO N/A
9. Was a separate container provided for measuring temperature? YES ✓ NO ___ Cooler Temp. 2.4° C

B. **LOG-IN PHASE:** Date samples were logged-in: 7-6-98 (Signature) Sheila Kittle

10. Describe type of packing in cooler: Loose ice, bubble paper, bubble bags
11. Were all bottles sealed in separate plastic bags? ..... YES NO N/A
12. Did all bottles arrive unbroken and were labels in good condition? ..... YES NO
13. Were bottle labels complete? ..... YES NO
14. Did all bottle labels agree with custody papers? ..... YES NO
15. Were correct containers used for the tests indicated? ..... YES NO
16. Was pH correct on preserved water samples? ..... YES NO N/A
17. Was a sufficient amount of sample sent for tests indicated? ..... YES NO
18. Were bubbles absent in VOA samples? If NO, list by sample #.: ______ YES NO N/A
19. Was the ARDL project coordinator notified of any deficiencies? ..... YES NO N/A

Comments and/or Corrective Action:	
(By: Signature)	Date:

Sample Transfer	
Fraction all	Fraction
Area # walkin	Area #
By S. Kittle	By
On 7-6-98	On

M\Admin\Forms\coolre2 Rev. 10/31/96

FedEx USA Airbill FedEx Tracking Number 804640331656 Form I.D. No. 0210 Recipient's Copy

1 From

Date 7/2/98 [redacted]

Sender's Name Doug Mulvey Phone (312) 831-3000

Company HARZA ENGINEERING COMPANY

Address 233 S WACKER DR FL 8

Dept./Floor/Suite/Room

CHICAGO State IL ZIP 60606

2 Your Internal Billing Reference Information

3 To

Recipient's Name S. Receipt Phone (618) 244-3258

Company AFDL, Inc.

Address Route 15 East, Airport

(To "HOLD" at FedEx location, print FedEx address here) Dept./Floor/Suite/Room

Check here if residence (Extra charge applies for FedEx Express Saver)

Mt Vernon State IL ZIP 62864

For HOLD at FedEx Location check here

- Hold Weekday (Not available with FedEx First Overnight)
- Hold Saturday (Not available at all locations) (Available for FedEx Priority Overnight and FedEx 2Day only)

For WEEKEND Delivery check here (Extra Charge. Not available at all locations)

- Saturday Delivery (Available for FedEx Priority Overnight and FedEx 2Day only)
- NEW Sunday Delivery (Available for FedEx Priority Overnight only)

8 0 4 6 4 0 3 3 1 6 5 6

4a Express Package Service *Packages under 150 lbs.* Delivery commitment may be later in some areas.

- [X] FedEx Priority Overnight (Next business morning)
- FedEx Standard Overnight (Next business afternoon)
- FedEx First Overnight (Earliest next business morning delivery to select locations) Higher rates apply
- FedEx 2Day (Second business day)
- FedEx Express Saver (Third business day)

FedEx Letter Rate not available. Minimum charge: One pound rate.

4b Express Freight Service *Packages over 150 lbs.* Delivery commitment may be later in some areas.

- FedEx Overnight Freight (Next business day)
- FedEx 2Day Freight (Second business day)
- FedEx Express Saver Freight (Up to 3 business days)

(Call for delivery schedule. See back for detailed descriptions of freight services.)

5 Packaging

- FedEx Letter
- FedEx Pak
- FedEx Box
- FedEx Tube
- [X] Other Pkg.

Declared value limit $500.

6 Special Handling

(One box must be checked)

Does this shipment contain dangerous goods?* No / Yes (As per attached Shipper's Declaration) / Yes (Shipper's Declaration not required)

Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg.

Cargo Aircraft Only

*Dangerous Goods cannot be shipped in FedEx packaging.

7 Payment

Bill to:

- [X] Sender (Account No. in Section 1 will be billed)
- Recipient
- Third Party
- Credit Card
- Cash/Check

Obtain Recipient FedEx Account No.

(Enter FedEx Account No. or Credit Card No. below)

[redacted]

Total Packages	Total Weight	Total Declared Value*	Total Charges
		$ .00	$

*When declaring a value higher than $100 per shipment, you pay an additional charge. See SERVICE CONDITIONS, DECLARED VALUE, AND LIMIT OF LIABILITY section for further information.

Credit Card Auth.

8 Release Signature

Your signature authorizes Federal Express to deliver this shipment without obtaining a signature and agrees to indemnify and hold harmless Federal Express from any resulting claims.

321

Questions?

Call 1·800·Go·FedEx® (800)463-3339

00522788

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Part #153023
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PRECLEANED CERTIFIED™
Certificate of Compliance

The enclosed containers have been chemically cleaned by using the specified USEPA cleaning procedures for low level chemical analysis. ESS containers meet and exceed the required detection limits established by theUSEPA in SPECIFICATIONS AND GUIDANCE FOR CONTAMINANT-FREE SAMPLE CONTAINERS.

5122

EXTRACTABLE ORGANIC COMPOUNDS

Analyte	Quantitation Limit (ug/L)
Pesticides / PCBs	
Alpha-BHC	< 0.01
Beta-BHC	< 0.01
Delta-BHC	< 0.01
Gamma-BHC (Lindane)	< 0.01
Heptachlor	< 0.01
Aldrin	< 0.01
Heptachlor Epoxide	< 0.01
Endosulfan I	< 0.01
Dieldrin	< 0.02
4,4'-DDE	< 0.02
Endrin	< 0.02
Endosulfan II	< 0.02
4,4'-DDD	< 0.02
Endosulfan Sulfate	< 0.02
4,4'-DDT	< 0.02
Methoxychlor	< 0.10
Endrin Ketone	< 0.02
Endrin Aldehyde	< 0.02
Alpha-Chlordane	< 0.01
Gamma-Chlordane	< 0.01
Toxaphene	< 1.0
Aroclor-1016	< 0.20
Aroclor-1221	< 0.20
Aroclor-1232	< 0.20
Aroclor-1242	< 0.20
Aroclor-1248	< 0.20
Aroclor-1254	< 0.20
Aroclor-1260	< 0.20
Aroclor-1262	< 0.20
Aroclor-1268	< 0.20
Semivolatiles	
Phenol	< 5
bis-(2-Chloroethyl) ether	< 5
bis-(2-Chloroisopropyl) ether	< 5
2-Chlorophenol	< 5
2-Methylphenol	< 5
2,2'-Oxybis-(1-Chloropropane)	< 5
4-Methylphenol	< 5
N-Nitroso-di-n-propylamine	< 5
Hexachloroethane	< 5
Nitrobenzene	< 5
Isophorone	< 5
2-Nitrophenol	< 5
2,4-Dimethylphenol	< 5
bis-(2-Chloroethoxy) methane	< 5
2,4-Dichlorophenol	< 5
1,2,4-Trichlorobenzene	< 5
Naphthalene	< 5
4-Chloroaniline	< 5
Hexachlorobutadiene	< 5
4-Chloro-3-Methylphenol	< 5
2-Methylnaphthalene	< 5
Hexachlorocyclopentadiene	< 5
2,4,6-Trichlorophenol	< 5
2,4,5-Trichlorophenol	< 20
1,2 Diphenylhydrazene	< 5
Carbazole	< 5
2-Chloronaphthalene	< 5
2-Nitroaniline	< 20
Dimethylphthalate	< 5
Acenaphthylene	< 5
2,6-Dinitrotoluene	< 5
3-Nitroaniline	< 20
Acenaphthene	< 5
2,4-Dinitrophenol	< 20
4-Nitrophenol	< 20
Dibenzofuran	< 5
2,4-Dinitrotoluene	< 5
Diethylphthalate	< 5
4-Chlorophenyl-Phenylether	< 5
Flourene	< 5
4-Nitroaniline	< 20
4,6-Dinitro-2-Methylphenol	< 20
N-Nitrosodiphenylamine	< 5
N-Nitrosodimethylamine	< 5
4-Bromophenyl-Phenylether	< 5
Hexachlorobenzene	< 5
Pentachlorophenol	< 20
Phenanthrene	< 5
Anthracene	< 5
Di-n-Butylphthalate	< 5
Fluoranthene	< 5
Pyrene	< 5
Butylbenzylphthalate	< 5
1,2'-Dichlorobenzene	< 5
1,3'-Dichlorobenzene	< 5
1,4'-Dichlorobenzene	< 5
3,3'-Dichlorobenzidine	< 5
Benzo[a]anthracene	< 5
Chrysene	< 5
bis-(2-Ethylhexyl) Phthalate	< 5
Di-n-Octylphthalate	< 5
Benzo[b]flouranthene	< 5
Benzo[k]flouranthene	< 5
Benzo[a]pyrene	< 5
Indeno(1,2,3-cd)pyrene	< 5
Dibenzo[a,h]anthracene	< 5
Benzo[g,h,i]perylene	< 5
Benzoic Acid	< 20
Benzyl Alcohol	< 5

PURGEABLE VOLATILE ORGANIC COMPOUNDS

Analyte	Quantitation Limit (ug/L)
Acetone	< 5
Benzene	< 1
Bromoform	< 1
Bromobenzene	< 1
Bromochloromethane	< 1
Bromodichloromethane	< 1
Bromomethane	< 1
z-Butylbenzene	< 5
n-Butylbenzene	< 1
sec-Butylbenzene	< 1
tert-Butylbenzene	< 1
Carbon Tetrachloride	< 1
Carbon Disulfide	< 1
Chlorobenzene	< 1
Chloroethane	< 1
Chloromethane	< 1
2-Chlorotoluene	< 1
4-Chlorotoluene	< 1
2,4-Chlorotoluene	< 1
Chloroform	< 1
Dibromomethane	< 1
1,2-Dibro 3-Chloropropane	< 1
Dibromochloromethane	< 1
1,2-Dibromoethane (EDB)	< 1
1,2-Dichlorobenzene	< 1
1,3-Dichlorobenzene	< 1
1,4-Dichlorobenzene	< 1
Dichlorodifluoromethane	< 1
1,1-Dichloroethane	< 1
1,2-Dichloroethane	< 1
1,1-Dichloroethene	< 1
cis-1,2-Dichloroethene	< 1
trans-1,2-Dichloroethene	< 1
1,2-Dichloropropane	< 1
1,3-Dichloropropane	< 1
2,2-Dichloropropane	< 1
1,1-Dichloropropene	< 1
cis-1,3-Dichloropropene	< 1
trans-1,3-Dichloropropene	< 1
Ethylbenzene	< 1
2-Hexanone	< 5
Hexachlorobutadiene	< 1
Isopropylbenzene	< 1
4-Isopropyltoluene	< 1
Methylene Chloride	< 2
Naphthalene	< 1
Propylbenzene	< 1
Styrene	< 1
1,1,1,2 Tetrachloroethane	< 1
1,1,2,2-Tetrachloroethane	< 1
Tetrachloroethene	< 1
Toluene	< 1
1,2,3,-Trichlorobenzene	< 1
1,2,4,-Trichlorobenzene	< 1
1,1,1-Trichloroethane	< 1
1,1,2-Trichloroethane	< 1
Trichloroethene	< 1
Trichlorofluoromethane	< 1
Trichlorotrifluoroethane	< 1
1,2,3-Trichloropropane	< 1
1,2,3-Trimethylbenzene	< 1
1,2,4-Trimethylbenzene	< 1
1,3,5-Trimethylbenzene	< 1
Vinyl Acetate	< 5
Vinyl Chloride	< 1
Methyl-Tert-Butyl-Ether	< 1
4-Methyl-2-pentanone	< 5
o-xylene	< 1
m-xylene (1)	< 1
p-xylene (1)	< 1

METALS, CYANIDE, & SULFIDE COMPOUNDS

Analyte	Detection Limit (ug/L)
Aluminum	< 80
Antimony	< 5
Arsenic	< 2
Barium	< 20
Barium (Amber HDPE)	< 50
Beryllium	< 0.5
Cadmium	< 1
Calcium	< 500
Calcium (HDPE)	< 100
Chromium	< 10
Cobalt	< 10
Copper	< 10
Iron	< 50
Lead	< 2
Magnesium	< 100
Manganese	< 10
Mercury	< 0.2
Nickel	< 20
Potassium	< 750
Potassium (HDPE)	< 100
Selenium	< 2
Silver	< 5
Sodium	< 5000
Sodium (HDPE)	< 100
Thallium	< 5
Vanadium	< 10
Zinc	< 10
Zinc (Amber HDPE)	< 500
Cyanide	< 10
Flouride	< 200
Nitrate+Nitrite	< 100

ESS
ENVIRONMENTAL SAMPLING SUPPLY

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052698

Matt Macy-Vice President ESS Inc.
Quality Assurance Manager

For information on our cleaning & monitoring procedures please call:
800-233-8425

Printed on recycled paper with soy inks

HARZA # 5123 **Project Name:** Cedar Lake, IN **Proj./D.O.#** 9070BA

Cedar Lake

ALASKA: Y / N (N circled)

Received: 7-3-98

Due Date: 7-24-98

STD-TA 15wk/days

RUSH-TA

EMERG-TA

* Indicates No Separate Container For Parameter

#	CUSTOMER #	DESCR/ LOCATION	Sediment		PCB	TOC 9060	TKN 351.2	Ammonia N 350.1	Total P 365.2	* Particle Size ASTM D422-63	* Hydrometers	TS	DATE COLLECTED	TIME COLLECTED
						1L	*	*	*	*	*	*		
1	SS02	SS02	✓			1	*	*	*	*	*	*	6/30	1430
2	01	01	✓			1	*	*	*	*	*	*	↓	1310
3	06	06	✓			1	*	*	*	*	*	*	7/1	1115
4	04	04	✓			1	*	*	*	*	*	*	6/30	1415
5	03	03	✓		*	1	*	*	*	*	*	*	↓	1545
6	19	19	✓			1	*	*	*	*	*	*	7/1	0945
7	07	07	✓		*	1	*	*	*	*	*	*	↓	1100
8	05	05	✓		*	1	*	*	*	*	*	*	6/30	1645
9	20	20	✓		*	1	*	*	*	*	*	*	7/1	0830
10	22	22	✓		*	1	*	*	*	*	*	*		1030
11	18	18	✓			1	*	*	*	*	*	*	↓	1015

*Sieve Size No. 4
No. 10
No. 40
No. 200
Hydrometers 74um
5um
1um

REC'D BY: Sheila Kittle DATE: 7-6-98 PAGE# 1 OF 1

m:\admin\flowsht Rev. 9/28/94

ARDL Inc. applied research & development laboratory

CHEMISTRY · BIOLOGY · PHYSIOLOGY
ENGINEERING · ENVIRONMENTAL ANALYSIS

5 August 1998

Mr. Doug Mulvey
Harza Environmental Services
Sears Tower
233 South Wacker
Chicago, IL 60606

RE: ARDL Report 5122
Site: Cedar Lake
Project #: 9070BA

Dear Mr. Mulvey:

Enclosed please find one (1) copy of ARDL's report for analysis of samples received on 7/03/98 from the referenced site. The report format consists of sample results with QC backup.

If there are any questions concerning this data package, or if additional information is required, please contact the undersigned at (618) 244-3235.

Thank you.

Sincerely yours,

D. Gillespie

Daniel J. Gillespie
Technical Services Manager

DJG/jcm

Enclosure

P.O. Box 1566 · Mt. Vernon Airport, Route 15 East · Mt. Vernon, Illinois 62864 · (618) 244-3235 · FAX (618) 244-1149

ARDL REPORT NO. 5122
HARZA ENVIRONMENTAL SERVICES
CEDAR LAKE
PROJECT NO. 9070BA

PCB-8081

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005122 | Report Date: 07/23/1998

Project Name:	CEDAR LAKE, IN	Analysis:	PCB'S
Project No.:	9070BA	Analytical Method:	8080A
		Prep Method:	3550A

Field ID:	SS15	ARDL Lab No.:	005122-02
Desc/Location:	SS15	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	1745	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3215
% Moisture:	76.2	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	23.3	139	ND		UG/KG	1
AROCLOR 1221	38.2	282	ND		UG/KG	1
AROCLOR 1232	22.2	139	ND		UG/KG	1
AROCLOR 1242	23.3	139	ND		UG/KG	1
AROCLOR 1248	23.1	139	ND		UG/KG	1
AROCLOR 1254	22.7	139	ND		UG/KG	1
AROCLOR 1260	23	139	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	71%
TETRACHLORO-m-XYLENE	3-137	67%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 07/23/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA
Analysis: PCB'S
Analytical Method: 8080A
Prep Method: 3550A

Field ID:	SS17	ARDL Lab No.:	005122-04
Desc/Location:	SS17	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	1145	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/16/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3215
% Moisture:	38.3	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	9	53.5	ND		UG/KG	1
AROCLOR 1221	14.7	109	ND		UG/KG	1
AROCLOR 1232	8.6	53.5	ND		UG/KG	1
AROCLOR 1242	9	53.5	ND		UG/KG	1
AROCLOR 1248	8.9	53.5	ND		UG/KG	1
AROCLOR 1254	8.8	53.5	ND		UG/KG	1
AROCLOR 1260	8.9	53.5	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	77%
TETRACHLORO-m-XYLENE	3-137	72%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 07/23/1998

Project Name:	CEDAR LAKE, IN	Analysis:	PCB'S
Project No.:	9070BA	Analytical Method:	8080A
		Prep Method:	3550A

Field ID:	SS14	ARDL Lab No.:	005122-05
Desc/Location:	SS14	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	1615	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3215
% Moisture:	79.8	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	27.5	163	ND		UG/KG	1
AROCLOR 1221	45	332	ND		UG/KG	1
AROCLOR 1232	26.1	163	ND		UG/KG	1
AROCLOR 1242	27.5	163	ND		UG/KG	1
AROCLOR 1248	27.2	163	ND		UG/KG	1
AROCLOR 1254	26.7	163	ND		UG/KG	1
AROCLOR 1260	27.1	163	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	74%
TETRACHLORO-m-XYLENE	3-137	70%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 07/23/1998

Project Name:	CEDAR LAKE, IN	Analysis:	PCB'S
Project No.:	9070BA	Analytical Method:	8080A
		Prep Method:	3550A

Field ID:	SS11	ARDL Lab No.:	005122-08
Desc/Location:	SS11	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	1245	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/16/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3215
% Moisture:	19.8	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	6.9	41.1	ND		UG/KG	1
AROCLOR 1221	11.3	83.5	ND		UG/KG	1
AROCLOR 1232	6.6	41.1	ND		UG/KG	1
AROCLOR 1242	6.9	41.1	ND		UG/KG	1
AROCLOR 1248	6.9	41.1	ND		UG/KG	1
AROCLOR 1254	6.7	41.1	ND		UG/KG	1
AROCLOR 1260	6.8	41.1	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	72%
TETRACHLORO-m-XYLENE	3-137	46%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 07/23/1998

Project Name: CEDAR LAKE, IN Analysis: PCB'S
Project No.: 9070BA Analytical Method: 8080A
Prep Method: 3550A

Field ID:	SS09	ARDL Lab No.:	005122-09
Desc/Location:	SS09	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	1215	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3215
% Moisture:	80.8	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	28.9	172	ND		UG/KG	1
AROCLOR 1221	47.3	349	ND		UG/KG	1
AROCLOR 1232	27.5	172	ND		UG/KG	1
AROCLOR 1242	28.9	172	ND		UG/KG	1
AROCLOR 1248	28.6	172	ND		UG/KG	1
AROCLOR 1254	28.1	172	ND		UG/KG	1
AROCLOR 1260	28.5	172	ND		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	88%
TETRACHLORO-m-XYLENE	3-137	93%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

METHOD BLANK REPORT
ARDL, Inc., Mt. Vernon Airport
Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 07/23/1998

Project Name:	CEDAR LAKE, IN	Analysis:	PCB'S
Project No.:	9070BA	Analytical Method:	8080A
		Prep Method:	3550A

Field ID:	NA	ARDL Lab No.:	005122-02B1
Desc/Location:	NA	Lab Filename:	
Sample Date:	NA	Received Date:	NA
Sample Time:	NA	Prep. Date:	07/14/1998
Matrix:	QC Material	Analysis Date:	07/16/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3215
% Moisture:	NA	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units
AROCLOR 1016	5.55	33.0	ND		UG/KG
AROCLOR 1221	9.08	67.0	ND		UG/KG
AROCLOR 1232	5.28	33.0	ND		UG/KG
AROCLOR 1242	5.55	33.0	ND		UG/KG
AROCLOR 1248	5.5	33.0	ND		UG/KG
AROCLOR 1254	5.4	33.0	ND		UG/KG
AROCLOR 1260	5.48	33.0	ND		UG/KG

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	87%
TETRACHLORO-m-XYLENE	3-137	74%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

MATRIX SPIKE/SPIKE DUPLICATE REPORT

ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005122

Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA

Analysis: PCB'S

Analytical Method: 8080A
Prep Method: 3550A

Field ID: SS15
Desc/Location: SS15
Sample Date: 07/01/1998
Sample Time: 1745
Matrix: SEDIMENT

Prep. Date: 07/14/1998
Amount Used: 30 g
% Moisture: 76.2
QC Batch: B3215
Level: LOW

ARDL Lab No.: 005122-02
Lab Filename:
Received Date: 07/03/1998
Analysis Date: 07/17/1998

Parameter	Sample Result	MS Result	MS Level	MS % Rec	MSD Result	MSD Level	MSD % Rec	% Rec Limits	RPD	RPD Limit
AROCLOR 1260	ND	843	1400	60.3	886	1400	63.3	50-150	5	25

SURROGATE RECOVERIES:	MS %R	MSD %R	%R Limits
DECACHLOROBIPHENYL	69	75	22-133
TETRACHLORO-m-XYLENE	68	68	3-137

'*' indicates a recovery outside of standard limits.

Matrix Spikes for 005122-02, PCB'S

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 08/04/1998

Project Name: CEDAR LAKE, IN Analysis: PCB'S
Project No.: 9070BA Analytical Method: 8080A
Prep Method: 3550A

Field ID:	SS15	ARDL Lab No.:	005122-02MS
Desc/Location:	SS15	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	1745	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3215
% Moisture:	76.2	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	23.3	139	ND		UG/KG	1
AROCLOR 1221	38.2	282	ND		UG/KG	1
AROCLOR 1232	22.2	139	ND		UG/KG	1
AROCLOR 1242	23.3	139	ND		UG/KG	1
AROCLOR 1248	23.1	139	ND		UG/KG	1
AROCLOR 1254	22.7	139	ND		UG/KG	1
AROCLOR 1260	23	139	843		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	69%
TETRACHLORO-m-XYLENE	3-137	68%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 08/04/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA
Analysis: PCB'S
Analytical Method: 8080A
Prep Method: 3550A

Field ID:	SS15	ARDL Lab No.:	005122-02MD
Desc/Location:	SS15	Lab Filename:	
Sample Date:	07/01/1998	Received Date:	07/03/1998
Sample Time:	1745	Prep. Date:	07/14/1998
Matrix:	SEDIMENT	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3215
% Moisture:	76.2	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units	Dilution Factor
AROCLOR 1016	23.3	139	ND		UG/KG	1
AROCLOR 1221	38.2	282	ND		UG/KG	1
AROCLOR 1232	22.2	139	ND		UG/KG	1
AROCLOR 1242	23.3	139	ND		UG/KG	1
AROCLOR 1248	23.1	139	ND		UG/KG	1
AROCLOR 1254	22.7	139	ND		UG/KG	1
AROCLOR 1260	23	139	886		UG/KG	1

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	75%
TETRACHLORO-m-XYLENE	3-137	68%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

BLANK SPIKE/SPIKE DUPLICATE REPORT

ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005122

Report Date: 07/23/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA

Analysis: PCB'S

Analytical Method: 8080A
Prep Method: 3550A

Matrix: QC Material
Amount Used: 30 g

QC Batch: B3215
Level: LOW

Prep. Date: 07/14/1998
Analysis Date: 07/17/1998

Parameter	Spike Result	Spike Level	Spike % Rec	Duplicate Result	Duplicate Level	Duplicate % Rec	Recovery Limits	RPD	RPD Limit
AROCLOR 1260	228	333	68	--	--	--	50-150	--	--

SURROGATE RECOVERIES:	Spike %R	Duplicate %R	%R Limits
DECACHLOROBIPHENYL	73.3	--	22-133
TETRACHLORO-m-XYLENE	66.1	--	3-137

'*' indicates a recovery outside of standard limits.
Spike Blanks for 005122-02, PCB'S

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 07/23/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA
Analysis: PCB'S
Analytical Method: 8080A
Prep Method: 3550A

Field ID:	NA	ARDL Lab No.:	005122-02K1
Desc/Location:	NA	Lab Filename:	
Sample Date:	NA	Received Date:	NA
Sample Time:	NA	Prep. Date:	07/14/1998
Matrix:	QC Material	Analysis Date:	07/17/1998
Amount Used:	30 g	Instrument ID:	
Final Volume:	1 mL	QC Batch:	B3215
% Moisture:	NA	Level:	LOW

Parameter	Method Limit	Reporting Limit	Result	Data Flag	Units
AROCLOR 1016	5.55	33	ND		UG/KG
AROCLOR 1221	9.08	67	ND		UG/KG
AROCLOR 1232	5.28	33	ND		UG/KG
AROCLOR 1242	5.55	33	ND		UG/KG
AROCLOR 1248	5.5	33	ND		UG/KG
AROCLOR 1254	5.4	33	ND		UG/KG
AROCLOR 1260	5.48	33	228		UG/KG

SURROGATE RECOVERIES:	Limits	Results
DECACHLOROBIPHENYL	22-133	73%
TETRACHLORO-m-XYLENE	3-137	66%

Surrogate recoveries marked with '*' indicates they are outside standard limits.

INORGANICS

INORGANIC ANALYSIS DATA PACKAGE

HARZA Environmental Services, Inc

Date: 08/06/98
ARDL Report No.: 5122

Lab Name: ARDL, Inc.
Samples Received at ARDL: 07/03/98
Project Name: Cedar Lake

CASE NARRATIVE

Sample ID No.	Date Collected	Lab ID No.	Analysis Requested
SS10	07/01/98	5122-01	Other Inorganics(1)
SS15	07/01/98	5122-02	Other Inorganics(1)
SS12	07/01/98	5122-03	Other Inorganics(1)
SS17	07/01/98	5122-04	Other Inorganics(1)
SS14	07/01/98	5122-05	Other Inorganics(1)
SS16	07/01/98	5122-06	Other Inorganics(1)
SS08	07/01/98	5122-07	Other Inorganics(1)
SS11	07/01/98	5122-08	Other Inorganics(1)
SS09	07/01/98	5122-09	Other Inorganics(1)
SS13	07/01/98	5122-10	Other Inorganics(1)
SS21	07/01/98	5122-11	Other Inorganics(1)

(1) Including ammonia-N, sieve analysis, TKN, TOC, total phosphorus and total solids.

The quality control data are summarized as follows:

LABORATORY CONTROL SAMPLES

Percent recovery of all LCS analyses were within control limits.

PREPARATION BLANKS

Results of all preparation blanks were within acceptable limits. The preparation blank during the TOC sequence of 7/24/98 exceeded the reporting limit but was less than 5% of the associated sample and is therefore valid.

MATRIX SPIKES

Percent recovery of all matrix spikes and matrix spike duplicates except 1 of 2 for total phosphorus were within control limits. Sample results for TKN and TOC were greater than 4 times the spike amount; therefore, percent recovery is not considered.

DUPLICATES

RPD on all duplicate analyses were within control limits.
All duplicate analyses are reported as MS/MSD except total solids which is reported as sample/duplicate.

INORGANIC ANALYSIS DATA PACKAGE

HARZA Environmental Services, Inc

Date: 07/29/98
ARDL Report No.: 5122

Lab Name: ARDL, Inc.
Samples Received at ARDL: 07/03/98
Project Name: Cedar Lake

CASE NARRATIVE

Release of the data contained in this package has been authorized by the Technical Services Manager or his designee as verified by the following signature.

D. Gillespie

Daniel J. Gillespie
Technical Services Manager

5122

HARZA Consulting Engineers and Scientists **№ 253**

SEARS TOWER • 233 South Wacker Drive • Chicago, Illinois 60606-6392 Tel: (312) 831-3800 • Fax: (312) 831-3999 • Telex: 25-3540

CHAIN OF CUSTODY RECORD

SITE: CEDAR LAKE

COOLER No. 98

SAMPLER: (Signature) Doug Mulvey

PROJECT No. 9070BA

PARAMETERS

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	No. OF CONTAINERS	Particle Size	Hydrometer	TOC	TKN	Ammonia N	Total P	PCB				REMARKS
SS10	7/1	1200		✓	SS10	1	✓	✓	✓	✓	✓	✓					Sediment, cold
SS15	7/1	1745		✓	SS15	1	✓	✓	✓	✓	✓	✓	✓				
SS12	7/1	1530		✓	SS12	1	✓	✓	✓	✓	✓	✓					
SS17	7/1	1645		✓	SS17	1	✓	✓	✓	✓	✓	✓	✓				
SS14	7/1	1615	✓		SS14	1	✓	✓	✓	✓	✓	✓	✓				
SS16	7/1	1715		✓	SS16	1	✓	✓	✓	✓	✓	✓					
SS08	7/1	1145		✓	SS08	1	✓	✓	✓	✓	✓	✓					
SS11	7/1	1245		✓	SS11	1	✓	✓	✓	✓	✓	✓	✓				
SS09	7/1	1215		✓	SS09	1	✓	✓	✓	✓	✓	✓	✓				
SS13	7/1	1600		✓	SS13	1	✓	✓	✓	✓	✓	✓					
SS21	7/1	915		✓	SS21	1	✓	✓	✓	✓	✓	✓					

TEMP Blank Included

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Douglas Mulvey	7/1/98						

Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks:
			Sheila Kettler	7/3/98	1045	

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

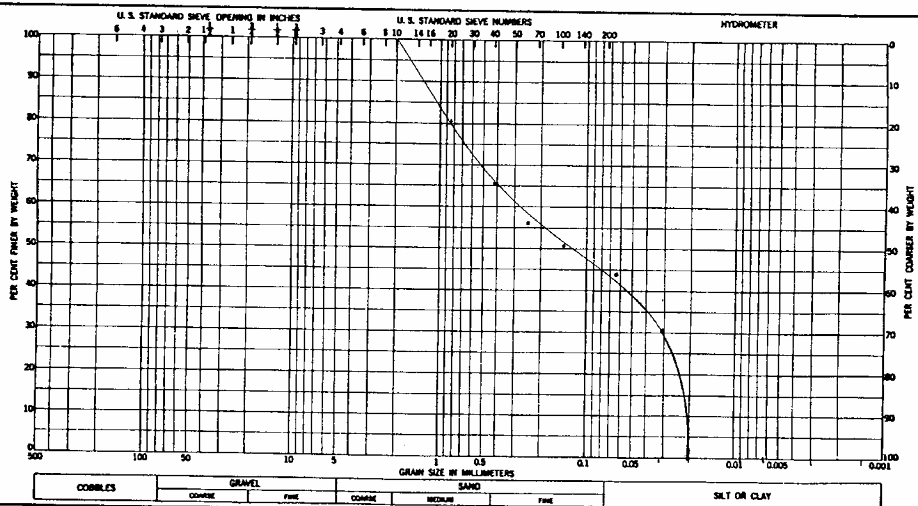
Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN Analysis: Inorganics
Project No: 9070BA

Field ID: SS10 ARDL No: 005122-01
Sampling Loc'n: SS10 Received: 07/03/1998
Sampling Date: 07/01/1998 Matrix: SEDIMENT
Sampling Time: 1200 Moisture: 79

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	700	7320	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	14.1	797	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	35.7	725	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	21.0	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	99400	MG/KG	NONE	9060M	NA	07/24/98	07295297

HOLCOMB FOUNDATION ENGINEERING
P. O. Box 3344
Carbondale, IL 62902-3344



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-1						

REPORT OF SOIL ANALYSIS

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois

File No. H-98207

Date 7-30-98

HYDROMETER WORKSHEET   HOLCOMB FOUNDATION ENGINEERING CO.

Project #	H98207	Boring No.	
Project Name	ARDL	Sample No.	5122-1
Date	07/31/98	Test No.	

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	80.3	*	X	*	X	*	9.85
#40	*	65.1	*	X	*	X	*	17.45
#60	*	56.5	*	X	*	X	*	21.77
#100	*	50.6	*	X	*	X	*	24.69
#200	*	44.7	*	X	*	X	*	27.64
	*		*		*		*	
0.031	*	30.2	*	20	*	77	*	X
0.020	*	2.2	*	6	*	77	*	X
0.009	*	0.0	*	2	*	76	*	X
0.0063	*	0.0	*	1	*	76	*	X
0.0031	*	0.0	*	0.5	*	75	*	X
0.0014	*	0.0	*	0	*	75	*	X

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 07/29/1998

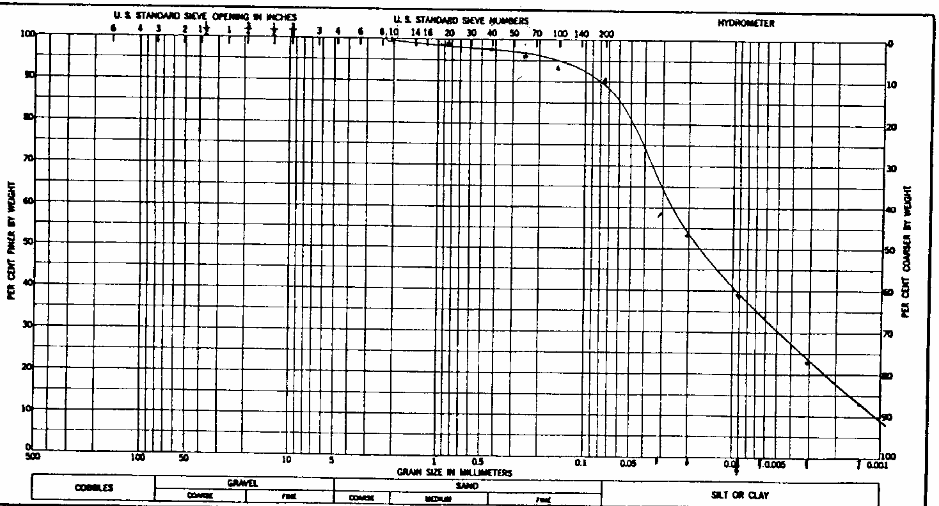
Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS15
Sampling Loc'n: SS15
Sampling Date: 07/01/1998
Sampling Time: 1745

ARDL No: 005122-02
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 76.2

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	500	6140	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	11.4	150	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	26.3	268	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	23.8	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	119000	MG/KG	NONE	9060M	NA	07/27/98	07295298

HOLCOMB FOUNDATION ENGINEERING
P. O. Box 3344
Carbondale, IL 62902-3344



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-2						

REPORT OF SOIL ANALYSIS

Project	Laboratory Tests
	ARDL
	Mt. Vernon, Illinois
File No.	H-98207
Date	7-30-98

Project #	H98060	Boring No.	
Project Name	B-Creek	Sample No.	5122-2
Date	03/28/98	Test No.	

Grain Size	% Passing	Hydrometer	Temperature	Wt. Ret.
#10	100.0	X	X	0
#20	99.3	X	X	0.34
#40	97.8	X	X	1.12
#60	95.6	X	X	2.18
#100	93.4	X	X	3.29
#200	90.0	X	X	4.98
0.031	59.2	35	75	X
0.020	54.2	32.5	75	X
0.009	39.2	25	75	X
0.0063	34.2	22.5	75	X
0.0031	22.8	17	74	X
0.0014	12.4	12	73	X

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois 62864

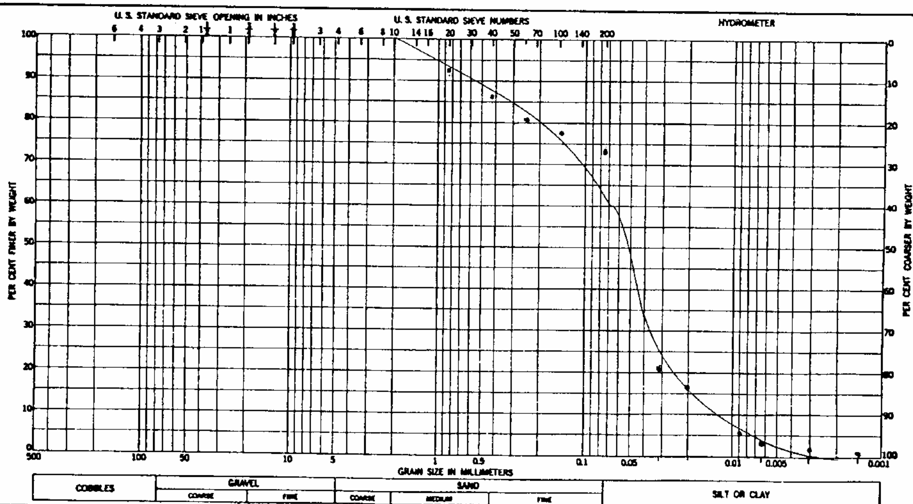
Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS12
Sampling Loc'n: SS12
Sampling Date: 07/01/1998
Sampling Time: 1530
ARDL No: 005122-03
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 82

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	731	8060	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	16.7	404	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	39.7	588	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	18.0	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	132000	MG/KG	NONE	9060M	NA	07/27/98	07295298

HOLCOMB FOUNDATION ENGINEERING
P. O. Box 3344
Carbondale, IL 62902-3344



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-3						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois

File No. H-98207

Date 7-30-98

REPORT OF SOIL ANALYSIS

Project #	H98207	Boring No.	
Project Name	ARDL	Sample No.	5122-3
Date	07/31/98	Test No.	

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	93.5	*	X	*	X	*	3.27
#40	*	86.7	*	X	*	X	*	6.65
#60	*	81.2	*	X	*	X	*	9.39
#100	*	77.4	*	X	*	X	*	11.28
#200	*	73.8	*	X	*	X	*	13.12
	*		*		*		*	
0.031	*	20.2	*	15	*	77	*	X
0.020	*	16.2	*	13	*	77	*	X
0.009	*	5.6	*	8	*	76	*	X
0.006	*	4.6	*	7.5	*	76	*	X
0.003	*	2.2	*	6.5	*	75	*	X
0.001	*	1.2	*	6	*	75	*	X

ARDL, INC.
Rt. 15E, Mt. Vernon Airport Industrial Park
Mt. Vernon, Illinois , 62864

Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS17
Sampling Loc'n: SS17
Sampling Date: 07/01/1998
Sampling Time: 1145

ARDL No: 005122-04
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 38.3

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	176	1400	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	4.6	43.6	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	10.6	370	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	61.7	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	16000	MG/KG	NONE	9060M	NA	07/27/98	07295298

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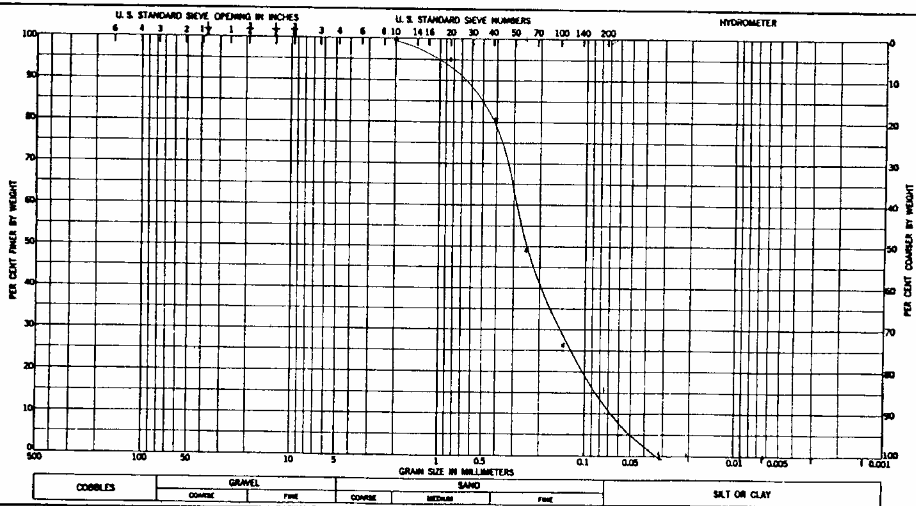

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-4						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

REPORT OF SOIL ANALYSIS

Project #	H98207	Boring No.	
Project Name	ARDL	Sample No.	5122-4
Date	07/31/98	Test No.	

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	95.0	*	X	*	X	*	2.51
#40	*	81.0	*	X	*	X	*	9.49
#60	*	48.8	*	X	*	X	*	25.61
#100	*	25.7	*	X	*	X	*	37.13
#200	*	16.7	*	X	*	X	*	41.67
	*		*		*		*	
0.031	*	0.0	*	4	*	75	*	X
0.020	*	0.0	*	2	*	75	*	X
0.009	*	0.0	*	0	*	75	*	X
0.006	*	0.0	*	0	*	75	*	X
0.003	*	0.0	*	0	*	74	*	X
0.001	*	0.0	*	0	*	73	*	X

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Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN Analysis: Inorganics
Project No: 9070BA

Field ID: SS14 ARDL No: 005122-05
Sampling Loc'n: SS14 Received: 07/03/1998
Sampling Date: 07/01/1998 Matrix: SEDIMENT
Sampling Time: 1615 Moisture: 79.8

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	589	8020	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	14.1	202	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	35.4	524	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	20.2	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	86000	MG/KG	NONE	9060M	NA	07/27/98	07295298

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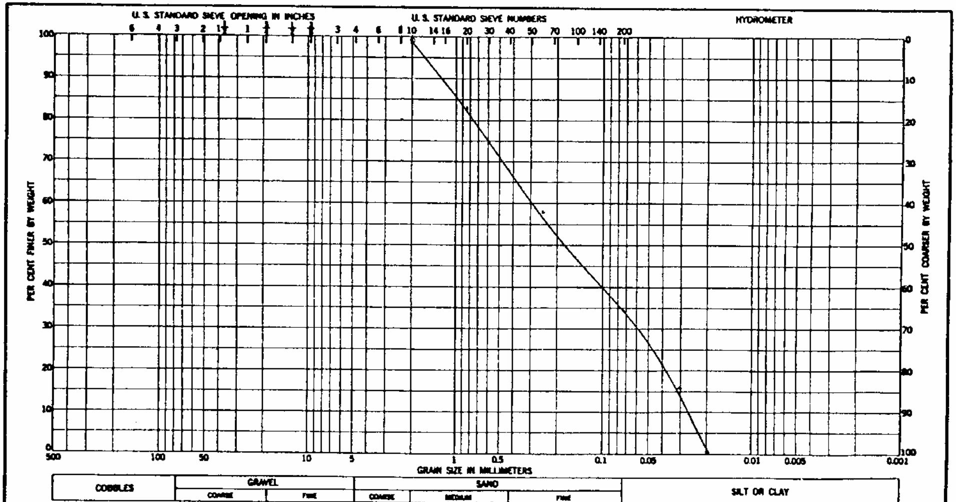

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-5						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois

File No. H-98207

Date 7-30-98

REPORT OF SOIL ANALYSIS

Project #	H98207
Project Name	ARDL
Date	#####

Boring No.
Sample No.	5122-5
Test No.

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	82.8	*	X	*	X	*	8.62
#40	*	68.2	*	X	*	X	*	15.9
#60	*	57.3	*	X	*	X	*	21.36
#100	*	46.9	*	X	*	X	*	26.54
#200	*	34.9	*	X	*	X	*	32.56
	*		*		*		*	
0.031	*	15.2	*	12.5	*	77	*	X
0.020	*	0.0	*	4.5	*	77	*	X
0.009	*	0.0	*	1.5	*	76	*	X
0.006	*	0.0	*	1	*	76	*	X
0.003	*	0.0	*	0.5	*	75	*	X
0.001	*	0.0	*	0	*	75	*	X

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Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN Analysis: Inorganics
Project No: 9070BA

Field ID: SS16 ARDL No: 005122-06
Sampling Loc'n: SS16 Received: 07/03/1998
Sampling Date: 07/01/1998 Matrix: SEDIMENT
Sampling Time: 1715 Moisture: 76.2

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	457	6930	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	11.5	558	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	28.6	539	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	23.8	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	98100	MG/KG	NONE	9060M	NA	07/27/98	07295298

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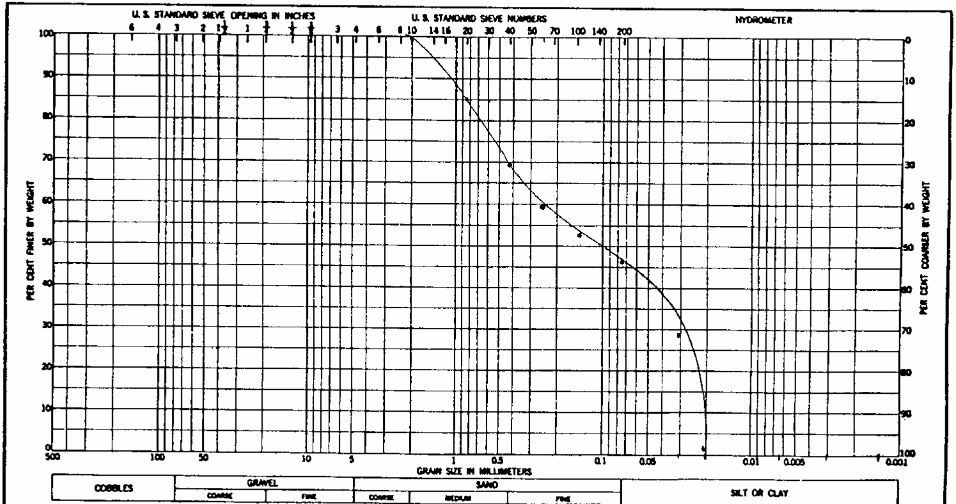

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-6						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois

File No. H-98207

Date 7-30-98

REPORT OF SOIL ANALYSIS

Project # H98207
Project Name ARDL
Date #####

Boring No.
Sample No. 5122-6
Test No.

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	85.1	*	X	*	X	*	7.46
#40	*	69.4	*	X	*	X	*	15.29
#60	*	59.8	*	X	*	X	*	20.12
#100	*	53.1	*	X	*	X	*	23.43
#200	*	46.6	*	X	*	X	*	26.72
	*		*		*		*	
0.031	*	28.2	*	19.5	*	75	*	X
0.020	*	1.2	*	6	*	75	*	X
0.009	*	0.0	*	1.5	*	75	*	X
0.006	*	0.0	*	1.5	*	75	*	X
0.003	*	0.0	*	0.5	*	74	*	X
0.001	*	0.0	*	0.5	*	73	*	X

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Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN Analysis: Inorganics
Project No: 9070BA

Field ID: SS08 ARDL No: 005122-07
Sampling Loc'n: SS08 Received: 07/03/1998
Sampling Date: 07/01/1998 Matrix: SEDIMENT
Sampling Time: 1145 Moisture: 79

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	496	5650	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	13.2	693	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	31.1	656	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	21.0	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	86800	MG/KG	NONE	9060M	NA	07/27/98	07295298

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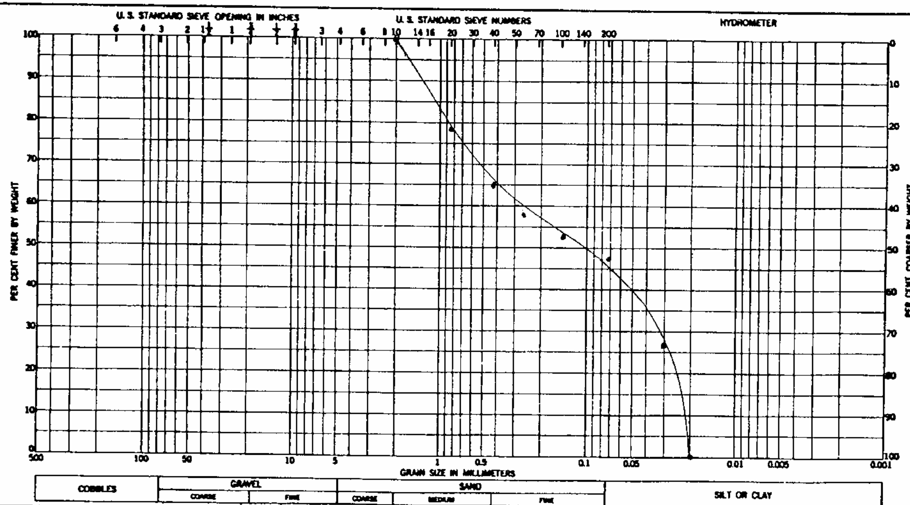

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-7						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

REPORT OF SOIL ANALYSIS

Project # H98207
Project Name ARDL
Date #####

Boring No.
Sample No. 5122-7
Test No.

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	78.3	*	X	*	X	*	10.84
#40	*	65.0	*	X	*	X	*	17.52
#60	*	57.5	*	X	*	X	*	21.23
#100	*	52.0	*	X	*	X	*	24
#200	*	47.2	*	X	*	X	*	26.4
	*		*		*		*	
0.031	*	26.2	*	18.5	*	75	*	X
0.020	*	0.0	*	4.5	*	75	*	X
0.009	*	0.0	*	2	*	75	*	X
0.006	*	0.0	*	2	*	75	*	X
0.003	*	0.0	*	0.5	*	74	*	X
0.001	*	0.0	*	0.5	*	73	*	X

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Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS11
Sampling Loc'n: SS11
Sampling Date: 07/01/1998
Sampling Time: 1245

ARDL No: 005122-08
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 19.8

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	14.2	151	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	3.6	4.4	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	1.9	72.6	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	80.2	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	1090	MG/KG	NONE	9060M	NA	07/27/98	07295298

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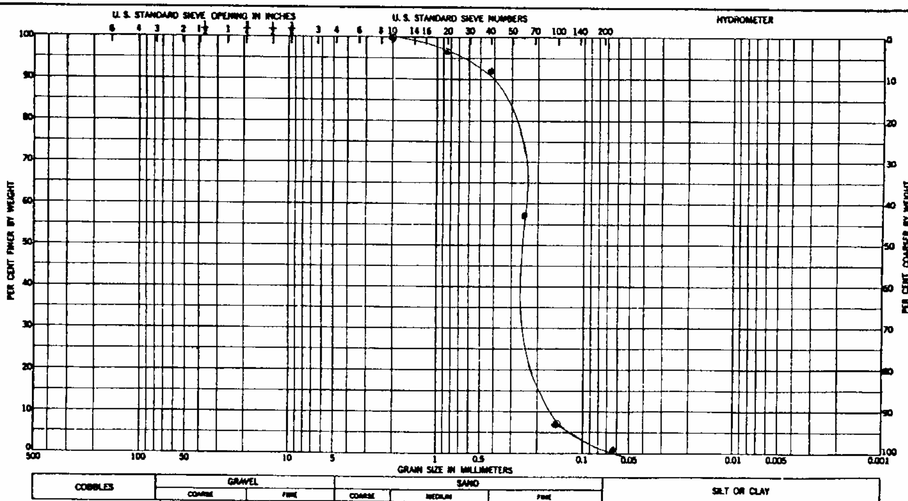

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-8						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

REPORT OF SOIL ANALYSIS

Project # H98207
Project Name ARDL
Date #####

Boring No.
Sample No. 5122-8
Test No.

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	97.7	*	X	*	X	*	1.16
#40	*	93.6	*	X	*	X	*	3.21
#60	*	57.4	*	X	*	X	*	21.3
#100	*	7.4	*	X	*	X	*	46.31
#200	*	0.8	*	X	*	X	*	49.62
	*		*		*		*	
0.031	*	0.0	*	0	*	75	*	X
0.020	*	0.0	*	0	*	75	*	X
0.009	*	0.0	*	0	*	75	*	X
0.006	*	0.0	*	0	*	75	*	X
0.003	*	0.0	*	0	*	74	*	X
0.001	*	0.0	*	0	*	73	*	X

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Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN
Project No: 9070BA
Analysis: Inorganics

Field ID: SS09
Sampling Loc'n: SS09
Sampling Date: 07/01/1998
Sampling Time: 1215
ARDL No: 005122-09
Received: 07/03/1998
Matrix: SEDIMENT
Moisture: 80.8

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	651	7660	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	15	237	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	37.2	395	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	19.2	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	132000	MG/KG	NONE	9060M	NA	07/27/98	07295298

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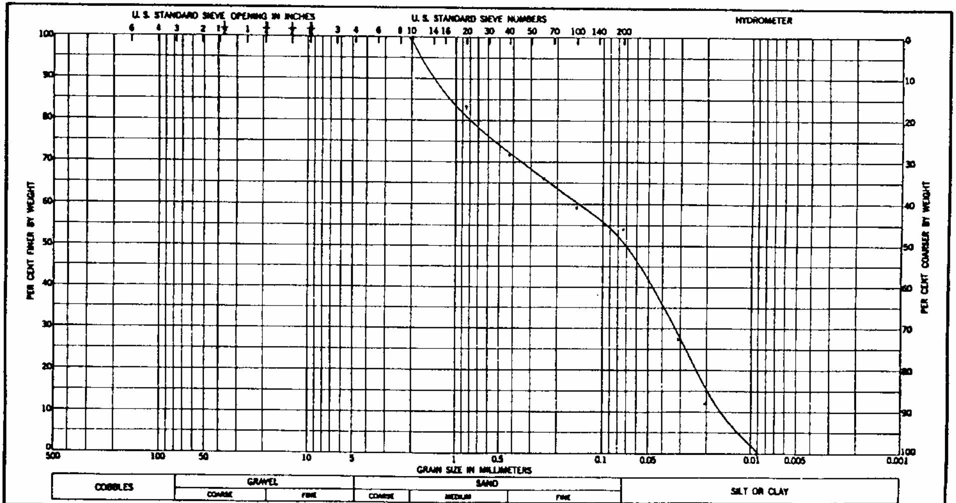

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-9						

Project	Laboratory Tests
	ARDL
	Mt. Vernon, Illinois
File No.	H-98207
Date	7-30-98

REPORT OF SOIL ANALYSIS

Project # H98207
Project Name ARDL
Date #####

Boring No.
Sample No. 5122-9
Test No.

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	83.5	*	X	*	X	*	8.23
#40	*	71.6	*	X	*	X	*	14.19
#60	*	65.3	*	X	*	X	*	17.37
#100	*	59.5	*	X	*	X	*	20.27
#200	*	54.3	*	X	*	X	*	22.84
	*		*		*		*	
0.031	*	27.2	*	18.5	*	77	*	X
0.020	*	12.2	*	11	*	77	*	X
0.009	*	0.0	*	2	*	76.5	*	X
0.006	*	0.0	*	1.5	*	76	*	X
0.003	*	0.0	*	0.5	*	75	*	X
0.001	*	0.0	*	0	*	75	*	X

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Lab Report No: 005122 Report Date: 07/29/1998

Project Name:	CEDAR LAKE, IN	Analysis:	Inorganics
Project No:	9070BA		

Field ID:	SS13	ARDL No:	005122-10
Sampling Loc'n:	SS13	Received:	07/03/1998
Sampling Date:	07/01/1998	Matrix:	SEDIMENT
Sampling Time:	1600	Moisture:	78.7

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	510	6400	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	14.1	675	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	35.2	581	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	21.3	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	94200	MG/KG	NONE	9060M	NA	07/27/98	07295298

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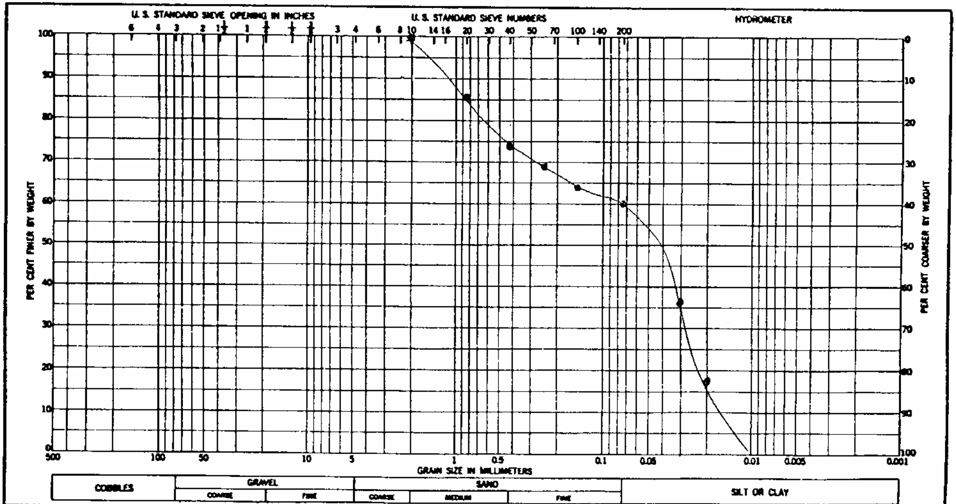

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-10						

REPORT OF SOIL ANALYSIS

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

Project # H98207
Project Name ARDL
Date #####

Boring No.
Sample No. 5122-10
Test No.

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	85.6	*	X	*	X	*	7.2
#40	*	74.8	*	X	*	X	*	12.62
#60	*	69.0	*	X	*	X	*	15.48
#100	*	64.3	*	X	*	X	*	17.84
#200	*	60.2	*	X	*	X	*	19.88
	*		*		*		*	
0.031	*	37.2	*	24	*	75	*	X
0.020	*	17.2	*	14	*	75	*	X
0.009	*	0.0	*	3	*	75	*	X
0.006	*	0.0	*	3.5	*	75	*	X
0.003	*	0.0	*	2	*	74	*	X
0.001	*	0.0	*	1	*	73	*	X

ARDL, INC.
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Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN Analysis: Inorganics
Project No: 9070BA

Field ID: SS21 ARDL No: 005122-11
Sampling Loc'n: SS21 Received: 07/03/1998
Sampling Date: 07/01/1998 Matrix: SEDIMENT
Sampling Time: 0915 Moisture: 78.2

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
KJELDAHL NITROGEN	478	6370	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295
NITROGEN, AMMONIA	13.5	238	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294
PHOSPHORUS, TOTAL	31.3	411	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293
SIEVE ANALYSIS		ATTACHED		D421	D422			
SOLIDS, TOTAL	1.0	21.8	%	NONE	160.3	NA	07/07/98	07295296
TOTAL ORGANIC CARBON	25	106000	MG/KG	NONE	9060M	NA	07/27/98	07295298

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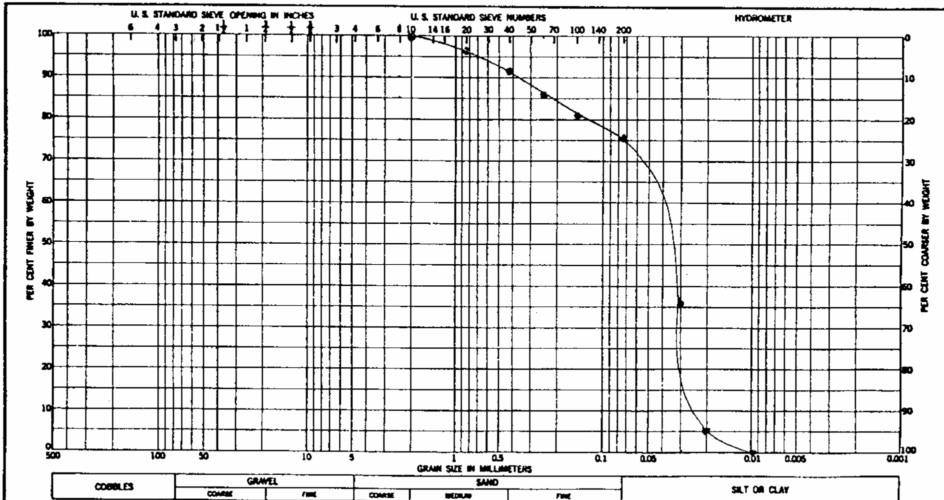

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-11						

REPORT OF SOIL ANALYSIS

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois
File No. H-98207
Date 7-30-98

Project # H98207
Project Name ARDL
Date #####

Boring No.
Sample No. 5122-11
Test No.

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	97.4	*	X	*	X	*	1.31
#40	*	91.9	*	X	*	X	*	4.05
#60	*	86.1	*	X	*	X	*	6.94
#100	*	81.1	*	X	*	X	*	9.43
#200	*	75.6	*	X	*	X	*	12.19
	*		*		*		*	
0.031	*	36.2	*	23.5	*	75	*	X
0.020	*	5.2	*	8	*	75	*	X
0.009	*	0.0	*	2	*	75	*	X
0.006	*	0.0	*	3	*	75	*	X
0.003	*	0.0	*	1	*	74	*	X
0.001	*	0.0	*	0.5	*	73	*	X

MATRIX SPIKE/SPIKE DUPLICATE REPORT
ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005122

Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA

Analyte	Sample Matrix	Sample Result	MS Result	MS Level	MS % Rec	MSD Result	MSD Level	MSD % Rec	% Rec Limits	RPD	RPD Limit	Run	QC Lab Number
KJELDAHL NITROGEN	SEDIMENT	7320	6980	395	0 *	7330	431	2 *	75-125	5	20	07295295	005122-01MS
NITROGEN, AMMONIA	SEDIMENT	4.4	124	123	97	119	117	98	75-125	4	20	07295294	005122-08MS
PHOSPHORUS, TOTAL	SEDIMENT	72.6	188	156	74 *	215	156	91	75-125	13	20	07295293	005122-08MS
TOTAL ORGANIC CARBON	SEDIMENT	99400	92000	5560	0 *	0	0	--	75-125	--	--	07295297	005122-01MS

NOTE: Any values tabulated above marked with an asterisk are outside of acceptable limits.

SAMPLE DUPLICATE REPORT
ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA

Analyte	Sample Conc'n	First Duplicate	Second Duplicate	Units	Percent Diff	Mean (Smp,D1,D2)	Analytical Run	QC Lab Number
SOLIDS, TOTAL	21.0	21.1	--	%	0	--	07295296	005122-01D1

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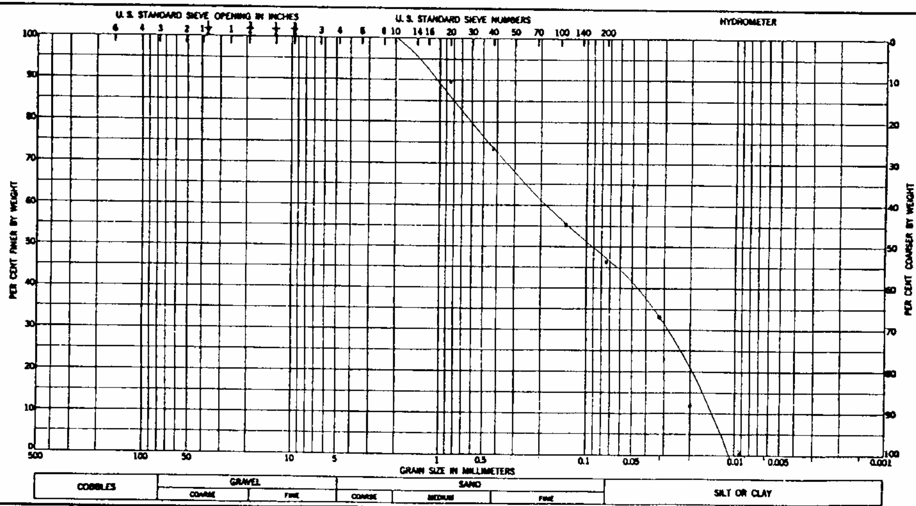

Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
	5122-1 (Dup)						

Project Laboratory Tests
ARDL
Mt. Vernon, Illinois

File No. H-98207

Date 7-30-98

REPORT OF SOIL ANALYSIS

Project Name H98207 ARDL
Date 07/31/98

Boring No.
Sample No. 5122-1 Dup
Test No.

Grain Size	*	% Passing	*	Hydrometer	*	Temperature	*	Wt. Ret.
#10	*	100.0	*	X	*	X	*	0
#20	*	89.0	*	X	*	X	*	5.51
#40	*	73.9	*	X	*	X	*	13.05
#60	*	63.2	*	X	*	X	*	18.39
#100	*	55.7	*	X	*	X	*	22.15
#200	*	46.2	*	X	*	X	*	26.92
	*		*		*		*	
0.031	*	34.2	*	22	*	77	*	X
0.020	*	12.2	*	11	*	77	*	X
0.009	*	0.0	*	1	*	76	*	X
0.0063	*	0.0	*	1	*	76	*	X
0.0031	*	0.0	*	1	*	75	*	X
0.0014	*	0.0	*	0.5	*	75	*	X

BLANK SUMMARY REPORT

ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005122

Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA

Analyte	Detect Limit	Blank Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run	QC Lab Number
KJELDAHL NITROGEN	12.5	ND	MG/KG	351.2	351.2	07/15/98	07/16/98	07295295	005122-01B1
NITROGEN, AMMONIA	3	ND	MG/KG	350.1	350.1	07/20/98	07/21/98	07295294	005122-08B1
PHOSPHORUS, TOTAL	1.5	ND	MG/KG	365.2	365.2	07/22/98	07/23/98	07295293	005122-08B1
SOLIDS, TOTAL	1	ND	%	NONE	160.3	NA	07/07/98	07295296	005122-01B1
TOTAL ORGANIC CARBON	25	36.1	MG/KG	NONE	9060M	NA	07/24/98	07295297	005122-01B1
TOTAL ORGANIC CARBON	25	ND	MG/KG	NONE	9060M	NA	07/27/98	07295298	005122-02B1

LABORATORY CONTROL SAMPLE REPORT

ARDL, INC. Rt. 15E, Mt. Vernon Airport Mt. Vernon, Illinois 62864

Lab Report No: 005122 Report Date: 07/29/1998

Project Name: CEDAR LAKE, IN
Project No.: 9070BA

Analyte	LCS 1 Result	LCS 1 Level	LCS 1 % Rec	LCS 2 Result	LCS 2 Level	LCS 2 % Rec	% Rec Limits	Mean % Rec	Analytical Run	QC Lab Number
KJELDAHL NITROGEN	1	1	100	--	--	--	80-120	--	07295295	005122-01C1
NITROGEN, AMMONIA	1	1	100	--	--	--	80-120	--	07295294	005122-08C1
PHOSPHORUS, TOTAL	0.67	0.67	100	--	--	--	80-120	--	07295293	005122-08C1
TOTAL ORGANIC CARBON	849	1000	85	--	--	--	80-120	--	07295298	005122-02C1

NOTE: Any values tabulated above marked with an asterisk are outside of acceptable limits.

CHAIN OF CUSTODY
DOCUMENTATION

5122

HARZA Consulting Engineers and Scientists

Nº 253

SEARS TOWER • 233 South Wacker Drive • Chicago, Illinois 60606-6392 Tel: (312) 831-3800 • Fax: (312) 831-3999 • Telex: 25-3540

CHAIN OF CUSTODY RECORD

SITE: CEDAR LAKE

COOLER No. 98

SAMPLER: (Signature) Doug Mulvey

PROJECT No. 9070BA

PARAMETERS

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	No. OF CONTAINERS	Particle Size	Hydrometers	TOC	TKN	Ammonia N	Total P	PCB			REMARKS
SS10	7/1	1200		✓	SS10	1	✓	✓	✓	✓	✓	✓				Sediment, cold
SS15	7/1	1745		✓	SS15	1	✓	✓	✓	✓	✓	✓	✓			
SS12	7/1	1530		✓	SS12	1	✓	✓	✓	✓	✓	✓				
SS17	7/1	1645		✓	SS17	1	✓	✓	✓	✓	✓	✓	✓			
SS14	7/1	1615		✓	SS14	1	✓	✓	✓	✓	✓	✓	✓			
SS16	7/1	1715		✓	SS16	1	✓	✓	✓	✓	✓	✓				
SS08	7/1	1145		✓	SS08	1	✓	✓	✓	✓	✓	✓				
SS11	7/1	1245		✓	SS11	1	✓	✓	✓	✓	✓	✓	✓			
SS09	7/1	1215		✓	SS09	1	✓	✓	✓	✓	✓	✓	✓			
SS13	7/1	1600		✓	SS13	1	✓	✓	✓	✓	✓	✓				
SS21	7/1	915		✓	SS21	1	✓	✓	✓	✓	✓	✓				
TEMP Blank Included																

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Douglas Mulvey	7/1/98						

Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks:
			Sheila Kettler	7/3/98	1045	

COOLER RECEIPT REPORT
ARDL, INC.

ARDL #: 5122

Cooler # 98

Number of Coolers In Shipment: 2

Project:: Cedar Lake

Date Received: 7/3/98

A. **PRELIMINARY EXAMINATION PHASE:** Date cooler was opened: 7/6/98 (Signature) Sheila Kittler

1. Did cooler come with a shipping slip (airbill, etc.)? .... **YES** NO
   If YES, enter carrier name and airbill number here: Fed Ex 804 640 331645
2. Were custody seals on outside of cooler? .... **YES** NO N/A
   How many and where? 2 front + back, Seal Date: 7/2/98, Seal Name: Doug Mulvey
3. Were custody seals unbroken and intact at the date and time of arrival? .... **YES** NO N/A
4. Did you screen samples for radioactivity using a Geiger Counter? .... **YES** NO
5. Were custody papers sealed in a plastic bag and taped inside to the lid? .... **YES** NO
6. Were custody papers filled out properly (ink, signed, etc.)? Crossout not initialed or dated; relinquished time not given .... YES **NO** N/A
7. Were custody papers signed in appropriate place by ARDL personnel? .... **YES** NO N/A
8. Was project identifiable from custody papers? If YES, enter project name at the top of this form .... **YES** NO N/A
9. Was a separate container provided for measuring temperature? YES ✓ NO ___ Cooler Temp. 2.7° C

B. **LOG-IN PHASE:** Date samples were logged-in: 7-6-98 (Signature) Sheila Kittler

10. Describe type of packing in cooler: loose ice, bubble paper, bubble bags
11. Were all bottles sealed in separate plastic bags? .... **YES** NO N/A
12. Did all bottles arrive unbroken and were labels in good condition? .... **YES** NO
13. Were bottle labels complete ? .... **YES** NO
14. Did all bottle labels agree with custody papers? .... **YES** NO
15. Were correct containers used for the tests indicated? .... **YES** NO
16. Was pH correct on preserved water samples? .... YES NO **N/A**
17. Was a sufficient amount of sample sent for tests indicated? .... **YES** NO
18. Were bubbles absent in VOA samples? If NO, list by sample #.: ____ YES NO **N/A**
19. Was the ARDL project coordinator notified of any deficiencies? .... **YES** NO N/A

Comments and/or Corrective Action:
(By: Signature) Date:

Sample Transfer	
Fraction: All	Fraction:
Area #: Walkin	Area #:
By: S. Kittler	By:
On: 7/6/98	On:

M\Admin\Forms\coolre2 Rev. 10/31/96

FedEx USA Airbill FedEx Tracking Number 804640331645 Form I.D. No. 0210 Recipient's Copy

1 From
Date 7/2 [redacted]
Sender's Name Doug Mulvey Phone (312) 831-3000
Company HARZA ENGINEERING COMPANY
Address 233 S WACKER DR FL 8 Dept/Floor/Suite/Room
City CHICAGO State IL ZIP 60606

2 Your Internal Billing Reference Information 9070 BA

3 To
Recipient's Name ARDL, INC, S. Receipt Phone (618) 244-3235
Company ARDL, INC
Address Route 15 East, Airport
☐ Check here if residence (Extra charge applies for FedEx Express Saver)
(To 'HOLD' at FedEx location, print FedEx address here) Dept/Floor/Suite/Room
City Mt. Vernon, State Il ZIP 62864

For HOLD at FedEx Location check here
☐ Hold Weekday (Not available with FedEx First Overnight)
☐ Hold Saturday (Not available at all locations) (Available for FedEx Priority Overnight and FedEx 2Day only)

For WEEKEND Delivery check here (Extra Charge. Not available at all locations)
☐ Saturday Delivery (Available for FedEx Priority Overnight and FedEx 2Day only)
☐ NEW Sunday Delivery (Available for FedEx Priority Overnight only)

8 0 4 6 4 0 3 3 1 6 4 5

4a Express Package Service *Packages under 150 lbs.* Delivery commitment may be later in some areas.
☒ FedEx Priority Overnight (Next business morning)
☐ FedEx Standard Overnight (Next business afternoon)
☐ FedEx First Overnight (Earliest next business morning delivery to select locations) Higher rates apply)
☐ FedEx 2Day (Second business day)
☐ FedEx Express Saver (Third business day)
FedEx Letter Rate not available. Minimum charge: One pound rate.

4b Express Freight Service *Packages over 150 lbs.* Delivery commitment may be later in some areas.
☐ FedEx Overnight Freight (Next business day)
☐ FedEx 2Day Freight (Second business day)
☐ FedEx Express Saver Freight (Up to 3 business days)
(Call for delivery schedule. See back for detailed descriptions of freight services.)

5 Packaging
☐ FedEx Letter ☐ FedEx Pak (Declared value limit $500) ☐ FedEx Box ☐ FedEx Tube ☒ Other Pkg.

6 Special Handling
Does this shipment contain dangerous goods?* (One box must be checked)
☐ No ☐ Yes (As per attached Shipper's Declaration) ☐ Yes (Shipper's Declaration not required)
☐ Dry Ice Dry Ice, 9, UN 1845 ______ x ______ kg.
☐ Cargo Aircraft Only
*Dangerous Goods cannot be shipped in FedEx packaging.

7 Payment
Bill to: ☒ Sender (Account No. in Section 1 will be billed) ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check
Obtain Recipient FedEx Account No.
(Enter FedEx Account No. or Credit Card No. below)

Total Packages	Total Weight	Total Declared Value*	Total Charges
1	101	$ .00	$

*When declaring a value higher than $100 per shipment, you pay an additional charge. See SERVICE CONDITIONS, DECLARED VALUE, AND LIMIT OF LIABILITY section for further information.

Credit Card Auth.

8 Release Signature

Your signature authorizes Federal Express to deliver this shipment without obtaining a signature and agrees to indemnify and hold harmless Federal Express from any resulting claims.

321

Questions?
Call 1·800·Go·FedEx (800)463-3339

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PRECLEANED CERTIFIED™

Certificate of Compliance

The enclosed containers have been chemically cleaned by using the specified USEPA cleaning procedures for low level chemical analysis. ESS containers meet and exceed the required detection limits established by theUSEPA in SPECIFICATIONS AND GUIDANCE FOR CONTAMINANT-FREE SAMPLE CONTAINERS.

5123

EXTRACTABLE ORGANIC COMPOUNDS

Analyte	Quantitation Limit (ug/L)
Pesticides / PCBs	
Alpha-BHC	< 0.01
Beta-BHC	< 0.01
Delta-BHC	< 0.01
Gamma-BHC (Lindane)	< 0.01
Heptachlor	< 0.01
Aldrin	< 0.01
Heptachlor Epoxide	< 0.01
Endosulfan I	< 0.01
Dieldrin	< 0.02
4,4'-DDE	< 0.02
Endrin	< 0.02
Endosulfan II	< 0.02
4,4'-DDD	< 0.02
Endosulfan Sulfate	< 0.02
4,4'-DDT	< 0.02
Methoxychlor	< 0.10
Endrin Ketone	< 0.02
Endrin Aldehyde	< 0.02
Alpha-Chlordane	< 0.01
Gamma-Chlordane	< 0.01
Toxaphene	< 1.0
Aroclor-1016	< 0.20
Aroclor-1221	< 0.20
Aroclor-1232	< 0.20
Aroclor-1242	< 0.20
Aroclor-1248	< 0.20
Aroclor-1254	< 0.20
Aroclor-1260	< 0.20
Aroclor-1262	< 0.20
Aroclor-1268	< 0.20
Semivolatiles	
Phenol	< 5
bis-(2-Chloroethyl) ether	< 5
bis-(2-Chloroisopropyl) ether	< 5
2-Chlorophenol	< 5
2-Methylphenol	< 5
2,2'-Oxybis-(1-Chloropropane)	< 5
4-Methylphenol	< 5
N-Nitroso-di-n-propylamine	< 5
Hexachloroethane	< 5
Nitrobenzene	< 5
Isophorone	< 5
2-Nitrophenol	< 5
2,4-Dimethylphenol	< 5
bis-(2-Chloroethoxy) methane	< 5
2,4-Dichlorophenol	< 5
1,2,4-Trichlorobenzene	< 5
Naphthalene	< 5
4-Chloroaniline	< 5
Hexachlorobutadiene	< 5
4-Chloro-3-Methylphenol	< 5
2-Methylnaphthalene	< 5
Hexachlorocyclopentadiene	< 5
2,4,6-Trichlorophenol	< 5
2,4,5-Trichlorophenol	< 20
1,2-Diphenylhydrazene	< 5
Carbazole	< 5
2-Chloronaphthalene	< 5
2-Nitroaniline	< 20
Dimethylphthalate	< 5
Acenaphthylene	< 5
2,6-Dinitrotoluene	< 5
3-Nitroaniline	< 20
Acenaphthene	< 5
2,4-Dinitrophenol	< 20
4-Nitrophenol	< 20
Dibenzofuran	< 5
2,4-Dinitrotoluene	< 5
Diethylphthalate	< 5
4-Chlorophenyl-Phenylether	< 5
Flourene	< 5
4-Nitroaniline	< 20
4,6-Dinitro-2-Methyphenol	< 20
N-Nitrosodiphenylamine	< 5
N-Nitrosodimethylamine	< 5
4-Bromophenyl Phenylether	< 5
Hexachlorobenzene	< 5
Pentachlorophenol	< 20
Phenanthrene	< 5
Anthracene	< 5
Di-n-Butylphthalate	< 5
Fluoroanthene	< 5
Pyrene	< 5
Butylbenzylphthalate	< 5
1,2'-Dichlorobenzene	< 5
1,3'-Dichlorobenzene	< 5
1,4'-Dichlorobenzene	< 5
3,3'-Dichlorobenzidine	< 5
Benzo[a]anthracene	< 5
Chyrsene	< 5
bis-(2-Ethylhexyl) Phthalate	< 5
Di-n-Octylphthalate	< 5
Benzo[b]flouranthene	< 5
Benzo[k]flouranthene	< 5
Benzo[a]pyrene	< 5
Indeno(1,2,3-cd)pyrene	< 5
Dibenzo[a,h]anthracene	< 5
Benzo[g,h,i]perylene	< 5
Benzoic Acid	< 20
Benzyl Alcohol	< 5

PURGEABLE VOLATILE ORGANIC COMPOUNDS

Analyte	Quantitation Limit (ug/L)
Acetone	< 5
Benzene	< 1
Bromoform	< 1
Bromobenzene	< 1
Bromochloromethane	< 1
Bromodichloromethane	< 1
Bromomethane	< 1
z-Butylbenzene	< 5
n-Butylbenzene	< 1
sec-Butylbenzene	< 1
tert-Butylbenzene	< 1
Carbon Tetrachloride	< 1
Carbon Disulfide	< 1
Chlorobenzene	< 1
Chloroethane	< 1
Chloromethane	< 1
2-Chlorotoluene	< 1
4-Chlorotoluene	< 1
2,4-Chlorotoluene	< 1
Chloroform	< 1
Dibromomethane	< 1
1,2-Dibro 3-Chloropropane	< 1
Dibromochloromethane	< 1
1,2-Dibromoethane (EDB)	< 1
1,2-Dichlorobenzene	< 1
1,3-Dichlorobenzene	< 1
1,4-Dichlorobenzene	< 1
Dichlorodifluoromethane	< 1
1,1-Dichloroethane	< 1
1,2-Dichloroethane	< 1
1,1-Dichloroethene	< 1
cis-1,2-Dichloroethene	< 1
trans-1,2-Dichloroethene	< 1
1,2-Dichloropropane	< 1
1,3-Dichloropropane	< 1
2,2-Dichloropropane	< 1
1,1-Dichloropropene	< 1
cis-1,3-Dichloropropene	< 1
trans-1,3-Dichloropropene	< 1
Ethylbenzene	< 1
2-Hexanone	< 5
Hexachlorobutadiene	< 1
Isopropylbenzene	< 1
4-Isopropyltoluene	< 1
Methylene Chloride	< 2
Naphthalene	< 1
Propylbenzene	< 1
Styrene	< 1
1,1,1,2-Tetrachloroethane	< 1
1,1,2,2-Tetrachloroethane	< 1
Tetrachloroethene	< 1
Toluene	< 1
1,2,3,-Trichlorobenzene	< 1
1,2,4,-Trichlorobenzene	< 1
1,1,1-Trichloroethane	< 1
1,1,2-Trichloroethane	< 1
Trichloroethene	< 1
Trichlorofluoromethane	< 1
Trichlorotrifluoroethane	< 1
1,2,3-Trichloropropane	< 1
1,2,3-Trimethylbenzene	< 1
1,2,4-Trimethylbenzene	< 1
1,3,5-Trimethylbenzene	< 1
Vinyl Acetate	< 5
Vinyl Chloride	< 1
Methyl-Tert-Butyl-Ether	< 1
4-Methyl-2-pentanone	< 5
o-xylene	< 1
m-xylene (1)	< 1
p-xylene (1)	< 1

METALS, CYANIDE, & SULFIDE COMPOUNDS

Analyte	Detection Limit (ug/L)
Aluminum	< 80
Antimony	< 5
Arsenic	< 2
Barium	< 20
Barium (Amber HDPE)	< 50
Beryllium	< 0.5
Cadmium	< 1
Calcium	< 500
Calcium (HDPE)	< 100
Chromium	< 10
Cobalt	< 10
Copper	< 10
Iron	< 50
Lead	< 2
Magnesium	< 100
Manganese	< 10
Mercury	< 0.2
Nickel	< 20
Potassium	< 750
Potassium (HDPE)	< 100
Selenium	< 2
Silver	< 5
Sodium	< 5000
Sodium (HDPE)	< 100
Thallium	< 5
Vanadium	< 10
Zinc	< 10
Zinc (Amber HDPE)	< 500
Cyanide	< 10
Flouride	< 200
Nitrate+Nitrite	< 100

ESS

ENVIRONMENTAL SAMPLING SUPPLY

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Matt Macy-Vice President, ESS Inc.
Quality Assurance Manager

052698

For information on our cleaning & monitoring procedures please call:
800-233-8425

HARZA # 5122 **Project Name:** Cedar Lake, IN **Proj./D.O.#** 9070BA

Cedar Lake
ALASKA: Y / (N)

Received: 7-3-98

Due Date: 7-24-98
STD-TA ______ 15 wk/days
RUSH-TA ______
EMERG-TA ______

* Indicates No Separate Container For Parameter

#	CUSTOMER #	DESCR/ LOCATION	Sediment		PCB	TOC 9060	TKN 351.2	Ammonia N 350.1	Total P 365.2	*Particle Size ASTM D422-63	*Hydrometers	TS						DATE COLLECTED	TIME COLLECTED
					*	1L	*	*	*	*	*	*							
1	5510	5510				1	*	*	*	*	*	*						7/1	1200
2	15	15			*	1	*	*	*	*	*	*							1745
3	12	12				1	*	*	*	*	*	*							1530
4	17	17			*	1	*	*	*	*	*	*							1645
5	14	14			*	1	*	*	*	*	*	*							1615
6	16	16				1	*	*	*	*	*	*							1715
7	08	08				1	*	*	*	*	*	*							1145
8	11	11			*	1	*	*	*	*	*	*							1245
9	09	09			*	1	*	*	*	*	*	*							1215
10	13	13				1	*	*	*	*	*	*							1600
11	21	21				1	*	*	*	*	*	*							0915

* Sieve Size No. 4.
No. 10
No. 40
No. 200
Hydrometers 74 um
5 um
1 um

REC'D BY: Sheila Kittle DATE: 7-6-98 PAGE# 1 OF 1

m:\admin\flowsht Rev. 9/28/94

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG

(Continued)

Sheet 1 of 1

PROJECT: CEDAR LAKE

Boring No.: SS01

Date: 6/30/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2½' Length Sediment Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: WATER

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									BROWN Silty SAND; trace organics	
1										
2										
3									Location: N 41°21.660' W 87°25.703'	
									Water Quality Measurements Temp. 27°C D.O. 7.60 mg/L Cond. 312 μmhos Air Temp. 28°C Secchi depth 0.95 ft pH 9.17 Depth 9.3'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 1 of 1

PROJECT: CEDAR LAKE

Boring No.: SS02

Date: 6/30/98 Checked By: Logged By: D. Mulvey Drilling Contractor: HARZA

Sampling Method(s): 2½' LENGTH SEDIMENT SAMPLER

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: WATER

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Dark brown silt	
1										
2										
3									Location: N 41°21.682' W 87°26.043'	
									Water Quality PARAMETERS WATER TEMP = 28°C AIR TEMP = 28°C D.O. = 7.7 mg/L @ 3' Cond. = 315 Mmhos pH = 9.01 Secchi depth = 12" Depth = 14'	

SOIL BORING LOG
(Continued)

HES HARZA ENVIRONMENTAL SERVICES, INC.

PROJECT: Cedar Lake

Sheet 1 of 1

Boring No.: SS03

Sampling Method(s): 2½ Length Sediment Sampler

Sample Dimensions: 2" diameter Hammer Weight/Drop: /

Surface Conditions: WATER

Date: 6/30/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
2										

Location: N 41° 21.390'
W 87° 26.170'

Water Quality Parameters
Water Temp = 27°C
Air Temp = 29°C
D.O. = 7.8 mg/L @ 3'
Cond = 312 µmhos
pH = 9.10
Secchi Depth = 0.85'
Depth = 11'

SOIL BORING LOG
(Continued)

HES HARZA ENVIRONMENTAL SERVICES, INC.

PROJECT: Cedar Lake

Sheet 1 of 1

Boring No.: SS04

Date: 6/30/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: Harza

Sampling Method(s): 2½' Length Sediment Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
2										
3									Location: N 41° 21.377' W 87° 26.004'	
									WATER Quality Parameters	
									WATER TEMP = 27°C	
									AIR TEMP = 29°C	
									D.O. = 6.7 mg/L @ 3'	
									Cond. = 310 µmhos	
									pH = 9.19	
									Secchi Depth = 0.9'	
									Depth = 12'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 1 of 1

PROJECT: CEDAR LAKE

Boring No.: SS05

Date: 6/30/98

Checked By:

Logged By: D Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2½' LENGTH SEDIMENT SAMPLER

Sample Dimensions: 2" dia. Hammer Weight/Drop: /

Surface Conditions: WATER

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									GRAY SANDY, silty clay; High Plasticity	
1										
									Location: N 41° 21.423' W 87° 25.866'	
2										
									WATER Quality Parameters	
									WATER TEMP = 27°C	
3									AIR TEMP = 28°C	
									D.O. = 8.4 mg/L @ 3'	
									Cond = 312 µmhos	
									pH = 9.28	
									Secchi Depth = 0.85'	
									Depth = 5'	

SOIL BORING LOG
(Continued)

HES HARZA ENVIRONMENTAL SERVICES, INC.

PROJECT: Cedar Lake

Sheet 1 of 1

Boring No.: SS06

Date: 7/1/93 Checked By: Logged By: D Mulvey Drilling Contractor: Harza

Sampling Method(s): 2½' Length Sediment Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
2										
									Location: N 41°21.764'	
									W 87°25.985'	
									WATER Quality Parameters	
									WATER TEMP = 27°C	
									AIR TEMP = 27°C	
									D.O. = 6.25 @ 4'	
									Cond. = 350	
									pH = 9.35	
									Secchi Depth = 0.55	
									Depth = 14	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 1 of 1

PROJECT: Cedar Lake

Boring No.: SS07

Date: 7/1/98

Checked By:

Logged By: L. Miller

Drilling Contractor: Harza

Sampling Method(s): 2 1/2' Length Sediment Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
									Location: N 41°21.894' W 87°25.977'	
									WATER Quality Parameters	
									WATER TEMP = 27°C	
									AIR TEMP = 28°C	
									D.O. = 6.40 @ 4'	; 6.00 @ 7'
									Cond. = 308 µmhos	
									pH = 9.15	
									Sedi. Depth = 0.85'	
									Depth = 10.5'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 1 of 1

PROJECT: Cedar Lake

Boring No.: SS08

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: Harza

Sampling Method(s): 2½' Length Sediment Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: Water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
2										
									Location N 41°22.092' W 87°25.556'	
									Water Quality Parameters	
									Water Temp - 27°C	
									Air Temp = 27°C	
									D.O. = 7.20 mg/L @ 4'	
									Cond. = 300 µmhos	
									pH = 9.16	
									Secchi Depth = 0.95'	
									Depth = 13.5'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

PROJECT: Cedar Lake

Sheet 1 of 1

Boring No.: SS09

Date: 7/1/98 Checked By: Logged By: D Mulvey Drilling Contractor: Harza

Sampling Method(s): 2½' Length Sediment Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: WATER

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt w/ trace Organics	
1										
2									Location: N 41°22.279' W 87°26.190'	
									WATER QUALITY PARAMETER	
									WATER TEMP = 27°C	
									AIR TEMP = 28°C	
									D.O. = 8.10 mg/l @ 4'	
									COND. = 308 Mmhos	
									pH = 9.38	
									Secchi Depth = 1.0'	
									Depth = 10'	

SOIL BORING LOG

(Continued)

HES HARZA ENVIRONMENTAL SERVICES, INC.

PROJECT: CEDAR LAKE

Sheet 1 of 1

Boring No.: SS10

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2 1/2' LENGTH SEDIMENT Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
2										

Location N 41°22.316'
W 87°25.970'

WATER Quality Parameters
WATER TEMP = 27°C
AIR TEMP = 27°C
D.O. = 7.35 mg/L @ 4'
COND. = 308 Mmhos
pH = 9.53
Secchi Depth = 1.1'
Depth = 14.5'

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 1 of 1

PROJECT: CEDAR LAKE

Boring No.: SS11

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: Harza

Sampling Method(s): 2½' LENGTH SEDIMENT Sample

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: WATER

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Fine brown SAND; trace organics; WELL SORTED	
1										
									Location N 41°22.280' W 87°25.746'	
2										
									WATER Quality Parameters WATER TEMP = 27°C AIR TEMP = 28°C D.O. = 6.85 mg/l @ 4' COND. = 303 Mmhos pH = 9.18 Secchi Depth = 1.0' Depth = 6.7'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 1 of 1

PROJECT: CEDAR Lake

Boring No.: SS12

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2½' LENGTH SEDIMENT Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: WATER

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
2										
3										
4									Location N 41°22.431' W 87°26.321'	
									WATER Quality Parameters WATER TEMP = 29°C AIR TEMP = 28°C D.O. = 8.6 mg/L @ 4' COND. = 285 Mmhos pH = 9.51 Secchi Depth = 1.05' Depth = 9.5'	; 8.7 mg/L @ 7'

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

PROJECT: CEDAR Lake

Sheet 1 of 1

Boring No.: SS13

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2 1/2' Length Sediment Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
2										
									Location: N 41°22.392' W 87°26.022'	
									WATER Quality Parameters WATER TEMP = 27.5°C AIR TEMP = 28°C D.O. = 8.8 mg/L @ 4' COND. = 300 µmhos pH = 9.31 Secchi Depth = 1.0' Depth = 14'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 1 of 1

PROJECT: CEDAR LAKE

Boring No.: SS14

Date: 7/1/75

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2 1/2' LENGTH SEDIMENT Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: Water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
									Black Silt w/ trace Clay	
2									Location: N 41°22.374', W 87°25.819'	
									WATER QUALITY Parameters	
									WATER TEMP = 27°C	
									AIR TEMP = 27°C	
									D.O. = [illegible] @ 4'	
									COND = 502 umhos	
									pH = [illegible]	
									Secchi Depth = 0.5'	
									Depth = 13.5'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

PROJECT: Cedar Lake

Sheet 1 of 1

Boring No.: SS15

Date: 7/1/98 Checked By: Logged By: D Mulvey Drilling Contractor: Harza

Sampling Method(s):

Sample Dimensions: Hammer Weight/Drop: /

Surface Conditions:

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
1									Black Clayey Silt w/ trace organics	
2									Location: N 41°22.567' W 87°26.176' WATER Quality Parameters WATER TEMP = 28°C AIR TEMP = 28°C D.O. = 9.50 mg/L @ 4' COND. = 300 μmhos pH = 9.27 Secchi Depth = 1.05' Depth = 9.5'	

HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

PROJECT: CEDAR LAKE

Sheet 1 of 1

Boring No.: SS16

Date: 7/1/99

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2½' LENGTH SEDIMENT Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: Water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									BLACK SILT	
1										
2									Location: N 41°22.525' W 87°25.907'	
									WATER Quality Parameters WATER TEMP = 28°C AIR TEMP = 26°C D.O. = 8.0 @ 4' Cond = 300 Mmhos pH = 9.47 Secchi Depth = 1.0' Depth = 13'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG

(Continued)

Sheet 1 of 1

PROJECT: CEDAR LAKE

Boring No.: SS17

Date: 7/1/59

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2 1/2' LENGTH SEDIMENT SAMPLE

Sample Dimensions: 2" DIA   Hammer Weight/Drop: /

Surface Conditions: WATER

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
.1									Black Silt w/ trace organics	
.2										
.3										
.4									Dark brown silty sand; trace organics; well sorted	
.5										
.6										
.7										
.8									Gray Sandy Clay w/ Trace Silt; High Plasticity	
.9										
1.0										

Location: N 41°22.622'
W 87°25.490'

WATER Quality Parameters

WATER TEMP	=	23°C
AIR TEMP	=	26°C
D.O.	=	8.60 mg/L @ 3'
COND.	=	305 µmho/cm
pH	=	9.70
Secchi Depth	=	1.05'
Depth	=	6.5'

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

PROJECT: CEDAR LAKE

Sheet 1 of 1

Boring No.: SS18

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2½' LENGTH SEDIMENT SAMPLER

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: Water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
1									Black Silt	
2									Location: N 41°22.718' W 87°25.839' WATER Quality Parameters WATER TEMP = 26°C AIR TEMP = 27°C D.O. = 6.60 mg/L @ 5' COND. = 298 Mmhos pH = 9.26 Secchi Depth = 0.85' Depth = 10'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 1 of 1

PROJECT: Cedar Lake

Boring No.: SS19

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: Harza

Sampling Method(s): 2½' Length Sediment Sampler

Sample Dimensions: ______ Hammer Weight/Drop: ____ / ____

Surface Conditions: water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt w/ Trace ORGANICS	
1										
2									Location N 41°22.728' W 87°25.659'	
									Water Quality Parameters Water Temp = 26.5°C Air Temp = 26°C D.O. = 7.5 mg/L @ 3' Cond. = 302 µmhos pH = 9.07 Secchi Depth = 0.9' Depth = 9'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 1 of 1

PROJECT:

Boring No.: SS20

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

Sampling Method(s): 2½' LENGTH SEDIMENT Sampler

Sample Dimensions: 2" dia. Hammer Weight/Drop: /

Surface Conditions: Water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
.1									FINE BROWN SAND, WELL Sorted	
.2									Gray Silty Clay, High Plasticity	
.3										
.4										
.5										
.6										
.7										
.8										
.9										
1.0										

LOCATION: N 41°22.895'
W 87°26.060'

WATER Quality Parameters
- WATER TEMP = 26°C
- AIR TEMP = 23°C
- D.O. = 6.55 mg/L @ 3
- COND. = 290 Mmhos
- pH = 9.21
- Secchi Depth = 0.90'
- Depth = 7'

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

PROJECT: Cedar Lake

Sheet 1 of 1

Boring No.: SS21

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: Harza

Sampling Method(s): 2½' Length Sediment Sampler

Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: Water

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt	
1										
2									Location: N 41°22.872' W 87°25.813'	
									Water Quality Parameters Water Temp = 26°C Air Temp = 24°C D.O. = 7.25 mg/l @ 4' Cond. = 295 Mmhos pH = 9.22 Secchi Depth = 0.9' Depth = 9.5'	

HES HARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

PROJECT: Cedar Lake

Sheet 1 of 1

Boring No.: SS22

Date: 7/1/98

Checked By:

Logged By: D. Mulvey

Drilling Contractor: HARZA

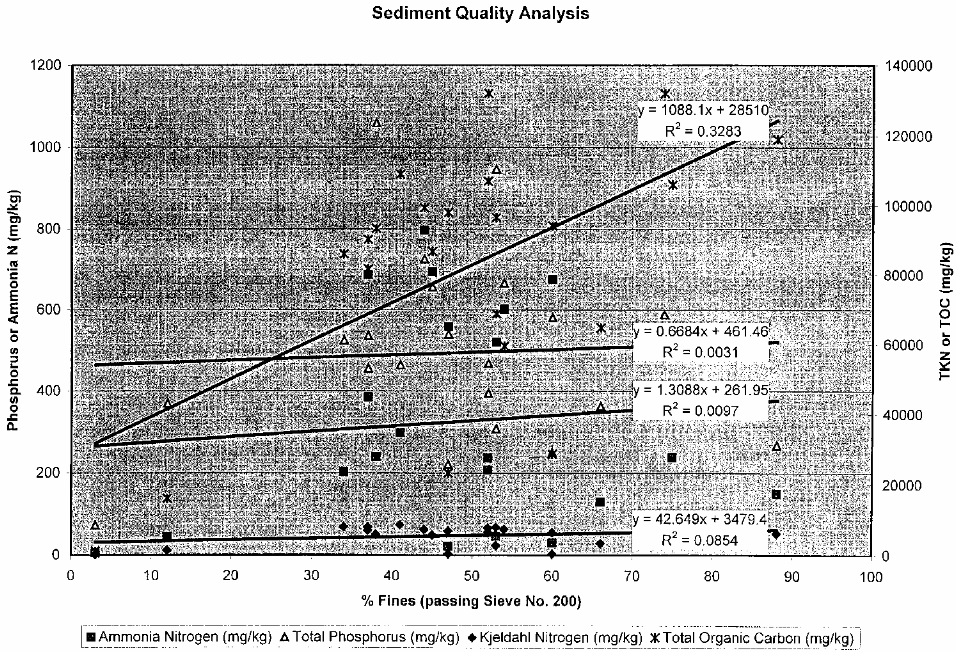
Sampling Method(s): 2½' Length Sediment Sampler

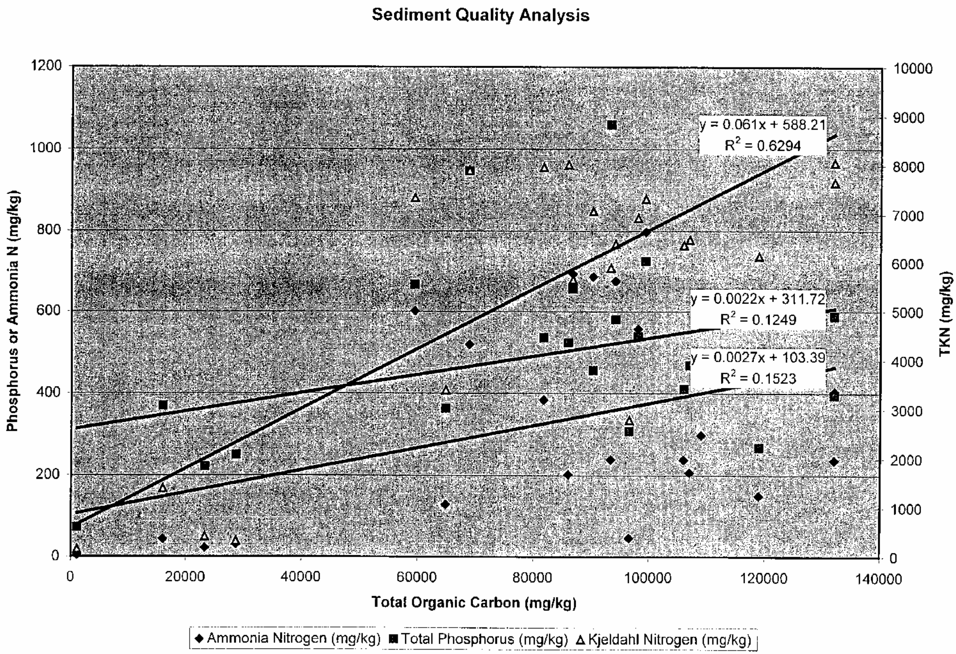
Sample Dimensions: 2" dia Hammer Weight/Drop: /

Surface Conditions: Water

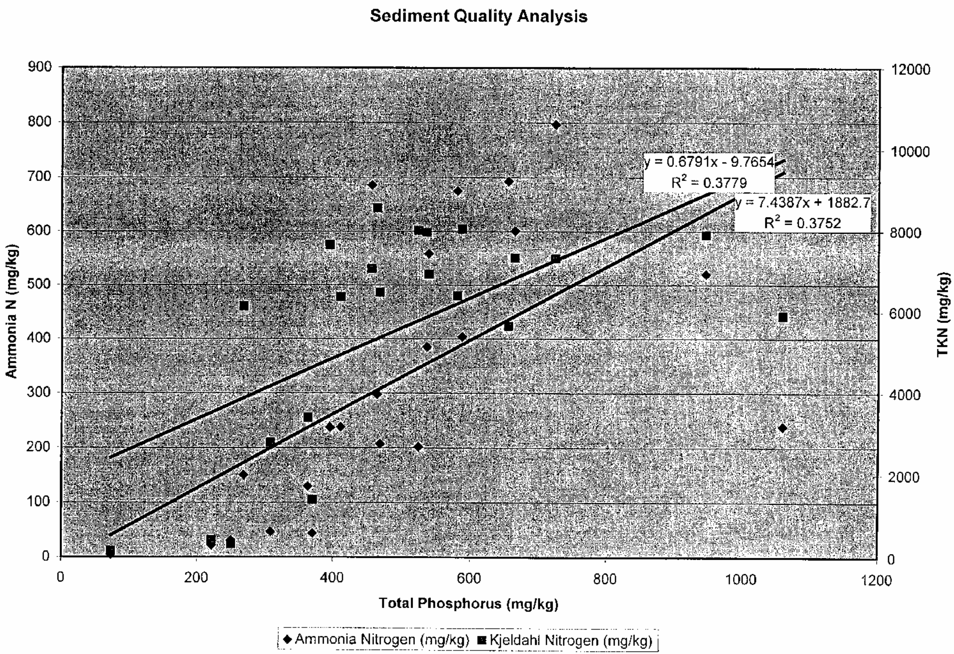
Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									Black Silt; Highly Organic; Leaves + roots visible	
1										
2										
									Location: N 41° 22.866' W 87° 25.637'	
									Water Quality Parameters Water Temp = 26°C Air Temp = 25°C D.O. = 7.75 mg/L @ 3' Cond. = 290 µmhos pH = 9.41 Secchi Depth = 0.95' Depth = 7.5'	

APPENDIX 2

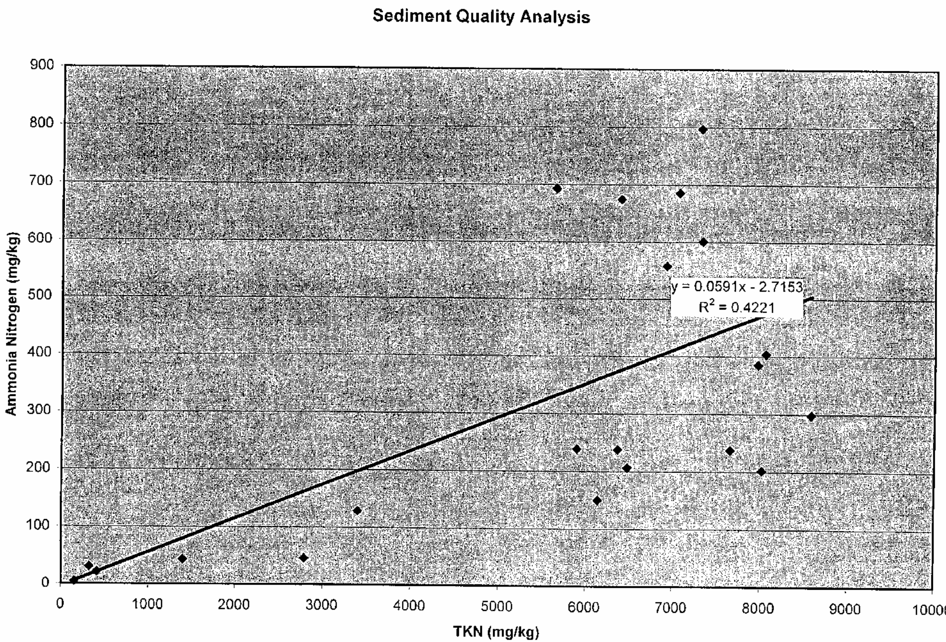

Sediment Quality Analysis
Phosphorus or Ammonia N (mg/kg)
TKN or TOC (mg/kg)
% Fines (passing Sieve No. 200)
0
200
400
600
800
1000
1200
0
20000
40000
60000
80000
100000
120000
140000
0
10
20
30
40
50
60
70
80
90
100
y = 1088.1x + 28510
R^2 = 0.3283
y = 0.6684x + 461.46
R^2 = 0.0031
y = 1.3088x + 261.95
R^2 = 0.0097
y = 42.649x + 3479.4
R^2 = 0.0854
Ammonia Nitrogen (mg/kg)
Total Phosphorus (mg/kg)
Kjeldahl Nitrogen (mg/kg)
Total Organic Carbon (mg/kg)



Sediment Quality Analysis
Phosphorus or Ammonia N (mg/kg)
TKN (mg/kg)
Total Organic Carbon (mg/kg)
y = 0.061x + 588.21
R² = 0.6294
y = 0.0022x + 311.72
R² = 0.1249
y = 0.0027x + 103.39
R² = 0.1523
0
200
400
600
800
1000
1200
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
0
20000
40000
60000
80000
100000
120000
140000
◆ Ammonia Nitrogen (mg/kg) ■ Total Phosphorus (mg/kg) Δ Kjeldahl Nitrogen (mg/kg)

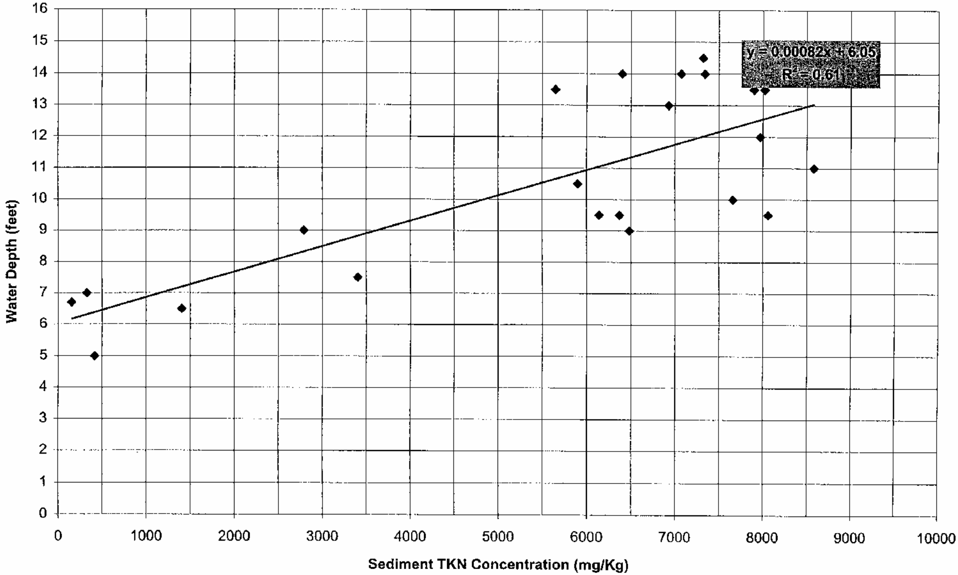


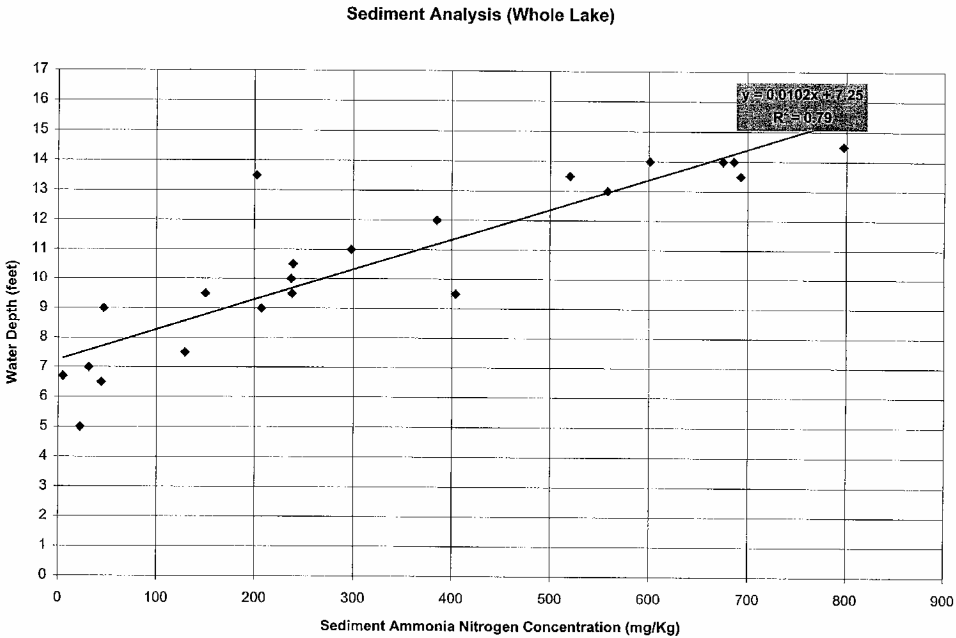
Sediment Quality Analysis
y = 0.6791x - 9.7654
R^2 = 0.3779
y = 7.4387x + 1882.7
R^2 = 0.3752
Ammonia N (mg/kg)
TKN (mg/kg)
Total Phosphorus (mg/kg)
0
100
200
300
400
500
600
700
800
900
0
2000
4000
6000
8000
10000
12000
0
200
400
600
800
1000
1200
◆ Ammonia Nitrogen (mg/kg) ■ Kjeldahl Nitrogen (mg/kg)



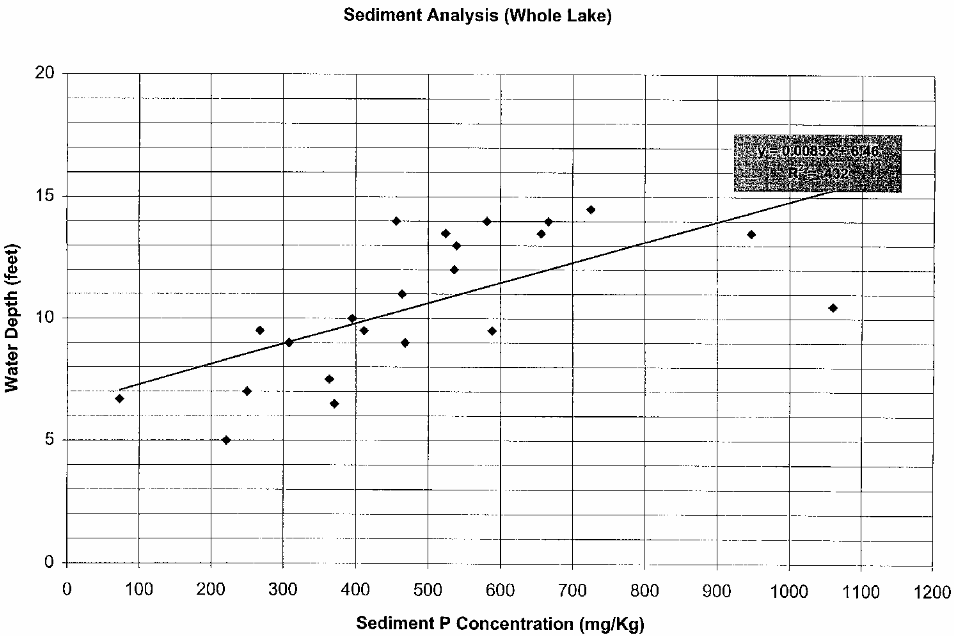
Sediment Quality Analysis
y = 0.0591x - 2.7153
R^2 = 0.4221
Ammonia Nitrogen (mg/kg)
TKN (mg/kg)
0
100
200
300
400
500
600
700
800
900
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

Sediment Analysis (Whole Lake)

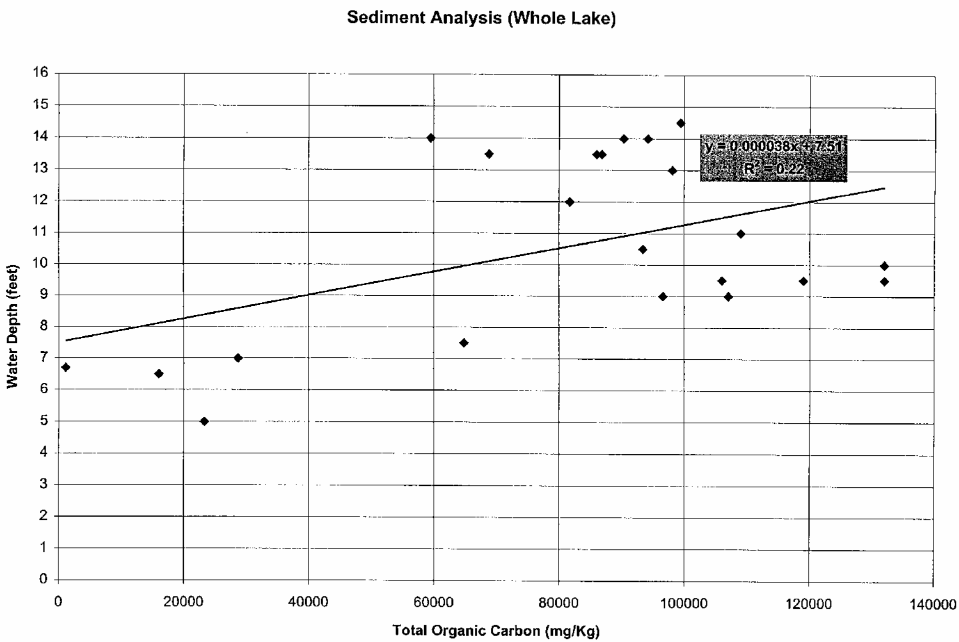


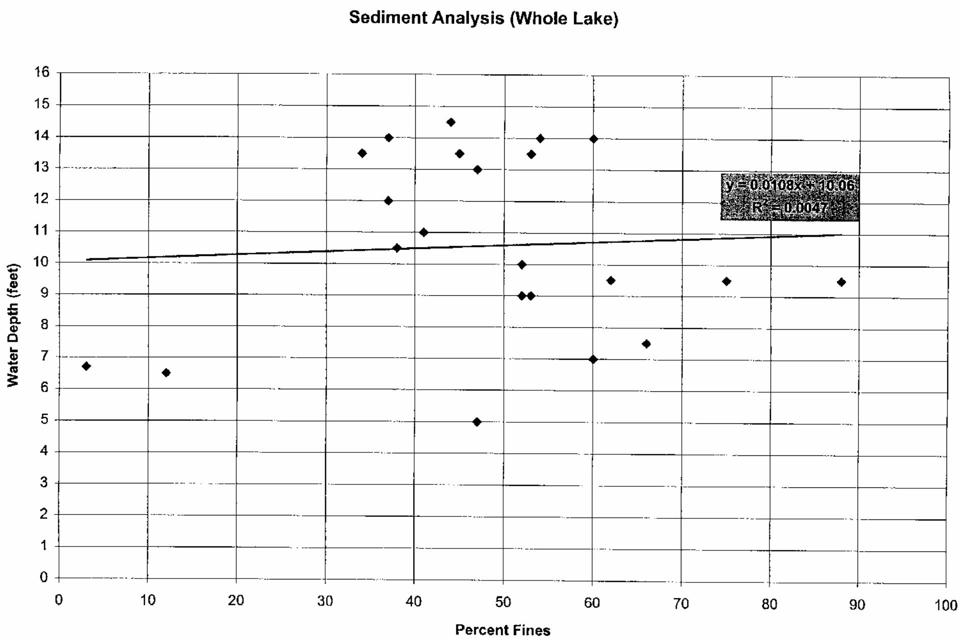


Sediment Analysis (Whole Lake)
y = 0.0102x + 7.25
R^2 = 0.79
Water Depth (feet)
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
100
200
300
400
500
600
700
800
900
Sediment Ammonia Nitrogen Concentration (mg/Kg)



Sediment Analysis (Whole Lake)
y = 0.0083x + 6.46
R^2 = .4324
Water Depth (feet)
0
5
10
15
20
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Sediment P Concentration (mg/Kg)


Sediment Analysis (Whole Lake)
y = 0.000038x + 7.51
R^2 = 0.22
Water Depth (feet)
Total Organic Carbon (mg/Kg)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
0
20000
40000
60000
80000
100000
120000
140000


Sediment Analysis (Whole Lake)
y = 0.0108x + 10.06
R² = 0.0047
Water Depth (feet)
Percent Fines
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
0
10
20
30
40
50
60
70
80
90
100

APPENDIX 3

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM-BIOLOGICAL STUDIES
SEDIMENT CONTAMINATION RESULTS
IDEM SAMPLE NUMBER:

LAB NUMBER: 70704438 SITE: CEDAR LAKE COUNTY: LAKE |SEDIMENT
COLLECTION DATE: 09-Jul-1987 LOCATION: NORTH BASIN LAB: HES |PREPARATION: COMPOSITE OF 3 GRABS

GENERAL PARAMETERS

% TOTAL SOLIDS		78.70
%MOISTURE		21.30
% VOLATILE SOLIDS		NA
NH3-N (mg/kg)		NA
A.V.S. (mg/kg)		NA
T.O.C. (%)		NA
CYANIDE		NA
		(MG/KG wet wt.)

METALS (dry wt.)		(MG/KG)
ALUMINUM		826.000
ANTIMONY	<	2.600
ARSENIC	<	1.300
BARIUM	<	6.400
BERYLLIUM	<	0.700
CADMIUM	<	0.700
CALCIUM		4080.00
CHROMIUM	<	1.300
COBALT	<	6.400
COPPER	<	3.200
IRON		1890.000
LEAD		3.800
MAGNESIUM		1650.000
MANGANESE		66.700
MERCURY	<	0.050
NICKEL	<	5.100
POTASSIUM	<	650.000
SELENIUM	<	1.300
SILVER	<	1.300
SODIUM	<	650.000
THALLIUM	<	2.600
VANADIUM	<	6.400
ZINC		8.500

PESTICIDES (dry wt.)		(MG/KG)
ALDRIN	<	0.0127
alpha-BHC	<	0.0064
beta-BHC	<	0.0064
delta-BHC	<	0.0064
gamma-BHC	<	0.0013
alpha-CHLORDANE	<	0.0013
gamma-CHLORDANE	<	0.0013
cis-NONACHLOR	<	0.0013
trans-NONACHLOR	<	0.0013
OXYCHLORDANE	<	0.0013
TOTAL CHLORDANE	<	0.0259
p,p'-DDD	<	0.0025
o,p'-DDD	<	0.0025
p,p'-DDE	<	0.0025
o,p'-DDE	<	0.0025
p,p'-DDT	<	0.0025
o,p'-DDT	<	0.0025
DIELDRIN	<	0.0013
ENDOSULFAN I	<	0.0127
ENDOSULFAN II	<	0.0127
ENDOSULFAN SULFATE	<	0.0127
ENDRIN	<	0.0127
ENDRIN ALDEHYDE	<	0.0064
ENDRIN KETONE	<	0.0064
HEPTACHLOR		0.0346
HEPTACHLOR EPOXIDE	<	0.0064
HEXACHLOROBENZENE	<	0.0064
METHOXYCHLOR	<	0.0127
PENTACHLOROANISOLE	<	0.0254
TOXAPHENE	<	0.2592

BASE/NEUTRAL EXTRACTABLE COMPOUNDS		(MG/KG)
ACENAPHTHYLENE	<	0.420
ACENAPHTHENE	<	0.420
ANILINE		NA
4-CHLOROANILINE	<	0.420
2-NITROANILINE	<	2.100
3-NITROANILINE	<	2.100
4-NITROANILINE	<	2.100
ANTHRACENE	<	0.420
BENZO(a)ANTHRACENE	<	0.420
DIBENZO(a,h)ANTHRACENE	<	0.420
3,3'-DICHLOROBENZIDINE	<	0.850
1,2-DICHLOROBENZENE	<	0.420
1,3-DICHLOROBENZENE	<	0.420
1,4-DICHLOROBENZENE	<	0.420
1,2,4-TRICHLORBENZENE	<	0.420
HEXACHLOROBENZENE	<	0.420
NITROBENZENE	<	0.420
BENZYL ALCOHOL	<	0.420
CARBAZOLE		NA
CHRYSENE	<	0.420
n-NITROSODIPHENYLAMINE	<	0.420
n-NITROSO-di-n-PROPYLAMINE	<	0.420
HEXACHLOROETHANE	<	0.420
BIS(2-CHLOROETHYL)ETHER	<	0.420
BIS(2-CHLOROISOPROPYL)ETHER	<	0.420
4-BROMOPHENYL-PHENYLETHER	<	0.420
4-CHLOROPHENYL-PHENYLETHER	<	0.420
FLUORANTHENE	<	0.420
FLUORENE	<	0.420
BENZO(beta)FLUORANTHENE	<	0.420
BENZO(kappa)FLUORANTHENE	<	0.420
DIBENZOFURAN	<	0.420
BIS(2-CHLOROETHOXY)METHANE	<	0.420
ISOPHORONE	<	0.420
NAPHTHALENE	<	0.420
2-CHLORONAPHTHALENE	<	0.420
2-METHYLNAPHTHALENE	<	0.420
HEXACHLOROCYCLOPENTADIENE	<	0.420
BENZO(ghi)PERYLENE	<	0.420
PHENANTHRENE	<	0.420
di-n-BUTYLPHTHALATE	BJ	0.300
DIETHYLPHTHALATE	<	0.420
DIMETHYLPHTHALATE	<	0.420
di-n-OCTYLPHTHALATE	<	0.420
BIS(2-ETHYLHEXYL)PHTHALATE	<	0.420
BUTYLBENZYLPHTHALATE	<	0.420
PYRENE	<	0.420
BENZO(alpha)PYRENE	<	0.420
INDENO(1,2,3-c,d)PYRENE	<	0.420
2,4-DINITROTOLUENE	<	0.420
2,6-DINITROTOLUENE	<	0.420
HEXACHLOROBUTADIENE	<	0.420
1,2-DIPHENYLHYDRAZINE		NA

ACID EXTRACTABLE COMPOUNDS		(MG/KG)
BENZOIC ACID	<	2.100
PHENOL	<	0.420
2-CHLOROPHENOL	<	0.420
2,4-DICHLOROPHENOL	<	0.420
2,4,5-TRICHLOROPHENOL	<	2.100
2,4,6-TRICHLOROPHENOL	<	0.420
PENTACHLOROPHENOL	<	2.100
2-METHYLPHENOL	<	0.420
4-METHYLPHENOL	J	0.160
2,4-DIMETHYLPHENOL	<	0.420
4-CHLORO-3-METHYLPHENOL	<	0.420
4,6-DINITRO-2-METHYLPHENOL	<	2.100
2-NITROPHENOL	<	0.420
4-NITROPHENOL	<	2.100
2,4-DINITROPHENOL	<	2.100

PCBs (dry wt.)		(MG/KG)
AROCLOR-1016	<	0.0508
AROCLOR-1221	<	0.0508
AROCLOR-1232	<	0.0508
AROCLOR-1242	<	0.0508
AROCLOR-1248	<	0.0508
AROCLOR-1254	<	0.0508
AROCLOR-1260	<	0.0508
AROCLOR-1262		NA

FUEL OIL		NA
GASOLINE		NA

VOLATILE ORGANIC COMPOUNDS (MG/KG)

ACETONE	B	0.136
BENZENE	<	0.006
CHLOROBENZENE	<	0.006
1,4-DICHLOROBENZENE		NA
ETHYLBENZENE	<	0.006
2-BUTANONE (MEK)	BJ	0.003
CARBON DISULFIDE	<	0.006
CHLOROETHANE	<	0.013
1,1-DICHLOROETHANE	<	0.006
1,2-DICHLOROETHANE	<	0.006
1,1,1-TRICHLOROETHANE	<	0.006
1,1,2-TRICHLOROETHANE	<	0.006
1,1,2,2-TETRACHLORETHANE	<	0.006
2-CHLOROETHYLVINYLETHER	<	0.013
1,1-DICHLOROETHYLENE	<	0.006
1,2-DICHLOROETHYLENE	<	0.006
TRICHLOROETHYLENE (TOTAL)	<	0.006
TETRACHLOROETHYLENE		0.006
2-HEXANONE	<	0.013
BROMOMETHANE	<	0.013
TRIBROMOMETHANE (BROMOFORM)	<	0.006
BROMODICHLOROMETHANE	<	0.006
DIBROMOCHLOROMETHANE	<	0.006
TRICHLOROFLUOROMETHANE		NA
CHLOROMETHANE	<	0.006
DICHLOROMETHANE (METHYLENE CHLORIDE)	B	0.018
TRICHLOROMETHANE (CHLOROFORM)	BJ	0.001
TETRACHLOROMETHANE (CARBON TETRACHLORIDE)	<	0.006
4-METHYL-2-PENTANONE	<	0.013
1,2-DICHLOROPROPANE	<	0.006
c-1,3-DICHLOROPROPYLENE	<	0.006
t-1,3-DICHLOROPROPYLENE	<	0.006
STYRENE	<	0.006
TOLUENE	BJ	0.001
VINYL ACETATE	<	0.013
VINYL CHLORIDE	<	0.013
TOTAL XYLENE	<	0.006

SEMIVOLATILE AND VOLATILE COMPOUNDS ARE REPORTED ON A DRY WT. BASIS. PRINT DATE: 17-Jun-1998
NA=NOT ANALYZED ND=NONE DETECTED D=DUPLICATE HES=HAZLETON ENVIRONMENTAL SERVICES, MADISON WISCONSIN
T.O.C.= TOTAL ORGANIC CARBON A.V.S.= ACID VOLATILE SULFIDES
OTHER FLAGS ARE EXPLAINED ON A SEPARATE SHEET

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM-BIOLOGICAL STUDIES
SEDIMENT CONTAMINATION RESULTS
IDEM SAMPLE NUMBER:

LAB NUMBER: 70704439 SITE: CEDAR LAKE COUNTY: LAKE | SEDIMENT
COLLECTION DATE: 09-Jul-1987 LOCATION: SOUTH BASIN LAB: HES | PREPARATION: COMPOSITE OF 3 GRABS

GENERAL PARAMETERS

% TOTAL SOLIDS	78.60
%MOISTURE	21.40
% VOLATILE SOLIDS	NA
NH3-N (mg/kg)	NA
A.V.S. (mg/kg)	NA
T.O.C. (%)	NA
CYANIDE	NA
	(MG/KG wet wt.)

METALS (dry wt.)		(MG/KG)
ALUMINUM		1390.000
ANTIMONY	<	2.600
ARSENIC		1.500
BARIUM		7.100
BERYLLIUM	<	0.700
CADMIUM	<	0.700
CALCIUM		10500.00
CHROMIUM		1.900
COBALT	<	6.400
COPPER	<	3.200
IRON		2800.000
LEAD		6.400
MAGNESIUM		5060.000
MANGANESE		102.000
MERCURY	<	0.050
NICKEL		5.100
POTASSIUM	<	650.000
SELENIUM	<	1.300
SILVER	<	1.300
SODIUM	<	650.000
THALLIUM	<	2.600
VANADIUM	<	6.400
ZINC		12.700

PESTICIDES (dry wt.)		(MG/KG)
ALDRIN	<	0.0127
alpha-BHC	<	0.0064
beta-BHC	<	0.0064
delta-BHC	<	0.0064
gamma-BHC	<	0.0013
alpha-CHLORDANE	<	0.0013
gamma-CHLORDANE	<	0.0013
cis-NONACHLOR	<	0.0013
trans-NONACHLOR	<	0.0013
OXYCHLORDANE	<	0.0013
TOTAL CHLORDANE	<	0.0260
p,p'-DDD	<	0.0025
o,p'-DDD	<	0.0025
p,p'-DDE	<	0.0025
o,p'-DDE	<	0.0025
p,p'-DDT	<	0.0025
o,p'-DDT	<	0.0025
DIELDRIN	<	0.0013
ENDOSULFAN I	<	0.0127
ENDOSULFAN II	<	0.0127
ENDOSULFAN SULFATE	<	0.0127
ENDRIN	<	0.0127
ENDRIN ALDEHYDE	<	0.0064
ENDRIN KETONE	<	0.0064
HEPTACHLOR	<	0.0064
HEPTACHLOR EPOXIDE	<	0.0064
HEXACHLOROBENZENE	<	0.0064
METHOXYCHLOR	<	0.0127
PENTACHLOROANISOLE	<	0.0254
TOXAPHENE	<	0.2595

BASE/NEUTRAL EXTRACTABLE COMPOUNDS		(MG/KG)
ACENAPHTHYLENE	<	0.420
ACENAPHTHENE	<	0.420
ANILINE		NA
4-CHLOROANILINE	<	0.420
2-NITROANILINE	<	2.100
3-NITROANILINE	<	2.100
4-NITROANILINE	<	2.100
ANTHRACENE	<	0.420
BENZO(a)ANTHRACENE	<	0.420
DIBENZO(a,h)ANTHRACENE	<	0.420
3,3'-DICHLOROBENZIDINE	<	0.850
1,2-DICHLOROBENZENE	<	0.420
1,3-DICHLOROBENZENE	<	0.420
1,4-DICHLOROBENZENE	<	0.420
1,2,4-TRICHLORBENZENE	<	0.420
HEXACHLOROBENZENE	<	0.420
NITROBENZENE	<	0.420
BENZYL ALCOHOL	<	0.420
CARBAZOLE		NA
CHRYSENE	J	0.014
n-NITROSODIPHENYLAMINE	<	0.420
n-NITROSO-di-n-PROPYLAMINE	<	0.420
HEXACHLOROETHANE	<	0.420
BIS(2-CHLOROETHYL)ETHER	<	0.420
BIS(2-CHLOROISOPROPYL) ETHER	<	0.420
4-BROMOPHENYL-PHENYLETHER	<	0.420
4-CHLOROPHENYL-PHENYLETHER	<	0.420
FLUORANTHENE	J	0.027
FLUORENE	<	0.420
BENZO(beta)FLUORANTHENE	<	0.420
BENZO(kappa)FLUORANTHENE	<	0.420
DIBENZOFURAN	<	0.420
BIS(2-CHLOROETHOXY)METHANE	<	0.420
ISOPHORONE	<	0.420
NAPHTHALENE	<	0.420
2-CHLORONAPHTHALENE	<	0.420
2-METHYLNAPHTHALENE	<	0.420
HEXACHLOROCYCLOPENTADIENE	<	0.420
BENZO(ghi)PERYLENE	<	0.420
PHENANTHRENE	J	0.008
di-n-BUTYLPHTHALATE	BJ	0.210
DIETHYLPHTHALATE	<	0.420
DIMETHYLPHTHALATE	<	0.420
di-n-OCTYLPHTHALATE	<	0.420
BIS(2-ETHYLHEXYL) PHTHALATE	BJ	0.038
BUTYLBENZYLPHTHALATE	<	0.420
PYRENE	J	0.025
BENZO(alpha)PYRENE	<	0.420
INDENO(1,2,3-c,d)PYRENE	<	0.420
2,4-DINITROTOLUENE	<	0.420
2,6-DINITROTOLUENE	<	0.420
HEXACHLOROBUTADIENE	<	0.420
1,2-DIPHENYLHYDRAZINE		NA

ACID EXTRACTABLE COMPOUNDS		(MG/KG)
BENZOIC ACID	<	0.420
PHENOL	<	0.420
2-CHLOROPHENOL	<	0.420
2,4-DICHLOROPHENOL	<	2.100
2,4,5-TRICHLOROPHENOL	<	2.100
2,4,6-TRICHLOROPHENOL	<	0.420
PENTACHLOROPHENOL	<	2.100
2-METHYLPHENOL	<	0.420
4-METHYLPHENOL	<	0.420
2,4-DIMETHYLPHENOL	<	0.420
4-CHLORO-3-METHYLPHENOL	<	0.420
4,6-DINITRO-2-METHYLPHENOL	<	2.100
2-NITROPHENOL	<	0.420
4-NITROPHENOL	<	2.100
2,4-DINITROPHENOL	<	2.100

PCBs (dry wt.)		(MG/KG)
AROCLOR-1016	<	0.0509
AROCLOR-1221	<	0.0509
AROCLOR-1232	<	0.0509
AROCLOR-1242	<	0.0509
AROCLOR-1248	<	0.0509
AROCLOR-1254	<	0.0509
AROCLOR-1260	<	0.0509
AROCLOR-1262		NA

FUEL OIL		NA
GASOLINE		NA
ACETONE	B	0.220
BENZENE	<	0.006
CHLOROBENZENE	<	0.006
1,4-DICHLOROBENZENE		NA
ETHYLBENZENE	<	0.006
2-BUTANONE (MEK)	BJ	0.005
CARBON DISULFIDE	J	0.002
CHLOROETHANE	<	0.013
1,1-DICHLOROETHANE	<	0.006
1,2-DICHLOROETHANE	<	0.006
1,1,1-TRICHLOROETHANE	<	0.006
1,1,2-TRICHLOROETHANE	<	0.006
1,1,2,2-TETRACHLOROETHANE	<	0.006
2-CHLOROETHYLVINYLETHER	<	0.013

VOLATILE ORGANIC COMPOUNDS		(MG/KG)
1,1-DICHLOROETHYLENE	<	0.006
1,2-DICHLOROETHYLENE	<	0.006
TRICHLOROETHYLENE (TOTAL)	<	0.006
TETRACHLOROETHYLENE		0.006
2-HEXANONE	<	0.013
BROMOMETHANE	<	0.013
TRIBROMOMETHANE (BROMOFORM)	<	0.006
BROMODICHLOROMETHANE	<	0.006
DIBROMOCHLOROMETHANE	<	0.006
TRICHLOROFLUOROMETHANE		NA
CHLOROMETHANE	<	0.013
DICHLOROMETHANE (METHYLENE CHLORIDE)	B	0.017
TRICHLOROMETHANE (CHLOROFORM)	BJ	0.001
TETRACHLOROMETHANE (CARBON TETRACHLORIDE)	<	0.006
4-METHYL-2-PENTANONE	<	0.013
1,2-DICHLOROPROPANE	<	0.006
c-1,3-DICHLOROPROPYLENE	<	0.006
t-1,3-DICHLOROPROPYLENE	<	0.006
STYRENE	<	0.006
TOLUENE	BJ	0.001
VINYL ACETATE	<	0.013
VINYL CHLORIDE	<	0.013
TOTAL XYLENE	<	0.006

SEMIVOLATILE AND VOLATILE COMPOUNDS ARE REPORTED ON A DRY WT. BASIS. PRINT DATE: 17-Jun-1998
NA-NOT ANALYZED ND-NONE DETECTED D-DUPLICATE HES-HAZLETON ENVIRONMENTAL SERVICES, MADISON WISCONSIN
T.O.C.- TOTAL ORGANIC CARBON A.V.S.- ACID VOLATILE SULFIDES
OTHER FLAGS ARE EXPLAINED ON A SEPARATE SHEET

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM-BIOLOGICAL STUDIES
FISH TISSUE CONTAMINATION RESULTS
IDEM SAMPLE NUMBER:

LAB NUMBER:70705702 SITE:**CEDAR LAKE** COUNTY:**LAKE** |SPECIES:3 CHANNEL CATFISH
COLLECTION DATE:09-Jul-1987 LOCATION: LAB:H |PREPARATION:WHOLE

MEAN LENGTH(CM):37.4 RANGE(CM):35.1-40.0 MEAN WEIGHT(GM):465 RANGE(GM):350-608 %LIPID:5.70

METALS		(MG/KG)
ALUMINUM		65.800
ANTIMONY	<	2.000
ARSENIC	<	0.600
BARIUM	<	5.000
BERYLLIUM	<	0.500
CADMIUM	<	0.500
CALCIUM		8280.00
CHROMIUM		1.800
COBALT	<	5.000
COPPER	<	2.500
IRON		103.000
LEAD	<	0.500
MAGNESIUM		450.000
MANGANESE		3.600
MERCURY	<	0.025
NICKEL	<	4.000
POTASSIUM		2290.000
SELENIUM	<	1.000
SILVER	<	0.500
SODIUM		1000.000
THALLIUM	<	2.000
VANADIUM	<	5.000
ZINC		26.100

PESTICIDES		(MG/KG)
ALDRIN	<	0.016
alpha-BHC	<	0.008
beta-BHC	<	0.008
delta-BHC	<	0.008
gamma-BHC	<	0.008
alpha-CHLORDANE	<	0.008
gamma-CHLORDANE	<	0.008
cis-NONACHLOR	<	0.008
trans-NONACHLOR	<	0.008
OXYCHLORDANE	<	0.008
p,p'-DDD		0.012
o,p'-DDD	<	0.010
p,p'-DDE		0.056
o,p'-DDE	<	0.010
p,p'-DDT	<	0.010
o,p'-DDT	<	0.010
DIELDRIN		0.012
ENDOSULFAN I	<	0.020
ENDOSULFAN II	<	0.020
ENDOSULFAN SULFATE	<	0.020
ENDRIN	<	0.010
ENDRIN ALDEHYDE	<	0.010
ENDRIN KETONE	<	0.010
HEPTACHLOR	B	0.067
HEPTACHLOR EPOXIDE	<	0.008
HEXACHLOROBENZENE	<	0.010
METHOXYCHLOR	<	0.020
PENTACHLOROANISOLE	<	0.008
TOXAPHENE		NA

TOTAL PCB 0.110 MG/KG

AROCLOR 1242	NA
AROCLOR 1248	NA
AROCLOR 1254	NA
AROCLOR 1260	NA

BASE/NEUTRAL EXTRACTABLE COMPOUNDS		(MG/KG)
ACENAPHTHYLENE	<	0.660
ACENAPHTHENE	<	0.660
4-CHLOROANILINE	<	0.660
2-NITROANILINE	<	3.200
3-NITROANILINE	<	3.200
4-NITROANILINE	<	3.200
ANTHRACENE	<	0.660
BENZO(a)ANTHRACENE	<	0.660
DIBENZO(a,h)ANTHRACENE	<	0.660
3,3'-DICHLOROBENZIDINE	<	1.300
1,2-DICHLOROBENZENE	<	0.660
1,3-DICHLOROBENZENE	<	0.660
1,4-DICHLOROBENZENE	<	0.660
1,2,4-TRICHLORBENZENE	<	0.660
HEXACHLOROBENZENE	<	0.660
NITROBENZENE	<	0.660
BENZYL ALCOHOL	<	0.660
CHRYSENE	<	0.660
n-NITROSODIPHENYLAMINE	<	0.660
n-NITROSO-di-n-PROPYLAMINE	<	0.660
HEXACHLOROETHANE	<	0.660
BIS(2-CHLOROETHYL)ETHER	<	0.660
BIS(2-CHLOROISOPROPYL)ETHER	<	0.660
4-BROMOPHENYL-PHENYLETHER	<	0.660
4-CHLOROPHENYL-PHENYLETHER	<	0.660
FLUORANTHENE	<	0.660
FLUORENE	<	0.660
BENZO(beta)FLUORANTHENE	<	0.660
BENZO(kappa)FLUORANTHENE	<	0.660
DIBENZOFURAN	<	0.660
BIS(2-CHLOROETHOXY)METHANE	<	0.660
ISOPHORONE	<	0.660
NAPHTHALENE	<	0.660
2-CHLORONAPHTHALENE	<	0.660
2-METHYLNAPHTHALENE	<	0.660
HEXACHLOROCYCLOPENTADIENE		NA
BENZO(ghi)PERYLENE	<	0.660
PHENANTHRENE	<	0.660
di-n-BUTYLPHTHALATE	<	0.660
DIETHYLPHTHALATE	<	0.660
DIMETHYLPHTHALATE	<	0.660
di-n-OCTYLPHTHALATE	<	0.660
BIS(2-ETHYLHEXYL)PHTHALATE	<	0.660
BUTYLBENZYLPHTHALATE	<	0.660
PYRENE	<	0.660
BENZO(alpha)PYRENE	<	0.660
INDENO(1,2,3-c,d)PYRENE	<	0.660
2,4-DINITROTOLUENE	<	0.660
2,6-DINITROTOLUENE	<	0.660
HEXACHLOROBUTADIENE	<	0.660

ACID EXTRACTABLE COMPOUNDS		(MG/KG)
BENZOIC ACID		NA
PHENOL	<	0.660
2-CHLOROPHENOL	<	0.660
2,4-DICHLOROPHENOL	<	0.660
2,4,5-TRICHLOROPHENOL	<	3.200
2,4,6-TRICHLOROPHENOL	<	0.660
PENTACHLOROPHENOL	<	3.200
2-METHYLPHENOL	<	0.660
4-METHYLPHENOL	<	0.660
2,4-DIMETHYLPHENOL	<	0.660
4-CHLORO-3-METHYLPHENOL	<	0.660
4,6-DINITRO-2-METHYLPHENOL		NA
2-NITROPHENOL	<	0.660
4-NITROPHENOL	<	3.200
2,4-DINITROPHENOL		NA

VOLATILE ORGANIC COMPOUNDS (MG/KG)

ACETONE	BE	0.850
BENZENE	J	0.002
CHLOROBENZENE	<	0.005
ETHYLBENZENE	<	0.005
2-BUTANONE		0.085
CARBON DISULFIDE	J	0.003
CHLOROETHANE	<	0.010
1,1-DICHLOROETHANE	<	0.005
1,2-DICHLOROETHANE	<	0.005
1,1,1-TRICHLOROETHANE	<	0.005
1,1,2-TRICHLOROETHANE	<	0.005
1,1,2,2-TETRACHLORETHANE	<	0.005
1,1-DICHLOROETHYLENE	<	0.005
1,2-DICHLOROETHYLENE	<	0.005
TRICHLOROETHYLENE (TOTAL)	<	0.005
TETRACHLOROETHYLENE	<	0.005
2-HEXANONE	<	0.010
BROMOMETHANE	<	0.050
TRIBROMOMETHANE (BROMOFORM)	<	0.025
BROMODICHLOROMETHANE	<	0.025
DIBROMOCHLOROMETHANE	<	0.025
CHLOROMETHANE	<	0.010
DICHLOROMETHANE (METHYLENE CHLORIDE)	B	0.072
TRICHLOROMETHANE (CHLOROFORM)	B	0.017
TETRACHLOROMETHANE (CARBON TETRACHLORIDE)	<	0.025
4-METHYL-2-PENTANONE	<	0.010
1,2-DICHLOROPROPANE	<	0.005
c-1,3-DICHLOROPROPYLENE	<	0.025
t-1,3-DICHLOROPROPYLENE	<	0.025
STYRENE	<	0.005
TOLUENE	BJ	0.003
VINYL ACETATE		NA
VINYL CHLORIDE	<	0.010
TOTAL XYLENE	X	0.005

RESULTS REPORTED ON A WHOLE SAMPLE BASIS. D=DUPLICATE
H-HAZLETON ENVIRONMENTAL SERVICES, MADISON, WI I=ISDH FOOD AND DRUG LAB
NA-NOT ANALYZED ND=NONE DETECTED
OTHER FLAGS ARE EXPLAINED ON A SEPA

PRINT DATE: 17-Jun-1998

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM-BIOLOGICAL STUDIES
FISH TISSUE CONTAMINATION RESULTS
IDEM SAMPLE NUMBER:

LAB NUMBER: 70705699 SITE: CEDAR LAKE COUNTY: LAKE |SPECIES: 3 CARP
COLLECTION DATE: 09-Jul-1987 LOCATION: LAB: H |PREPARATION: WHOLE

MEAN LENGTH (CM): 47.6 RANGE (CM): 44.8-51.0 MEAN WEIGHT (GM): 1154 RANGE (GM): 1078-1249 %LIPID: 8.60

METALS		(MG/KG)
ALUMINUM		47.200
ANTIMONY	<	2.000
ARSENIC	<	0.500
BARIUM	<	5.000
BERYLLIUM	<	0.500
CADMIUM	<	0.500
CALCIUM		8210.00
CHROMIUM	<	1.000
COBALT	<	5.000
COPPER	<	2.500
IRON		75.600
LEAD	<	0.500
MAGNESIUM		360.000
MANGANESE	<	1.500
MERCURY		0.052
NICKEL	<	4.000
POTASSIUM		2310.000
SELENIUM	<	1.000
SILVER	<	0.500
SODIUM		770.000
THALLIUM	<	2.000
VANADIUM	<	5.000
ZINC		92.700

PESTICIDES		(MG/KG)
ALDRIN	<	0.016
alpha-BHC	<	0.008
beta-BHC	<	0.008
delta-BHC	<	0.008
gamma-BHC	<	0.008
alpha-CHLORDANE		0.017
gamma-CHLORDANE		0.023
cis-NONACHLOR	<	0.008
trans-NONACHLOR		0.013
OXYCHLORDANE	<	0.008
p,p'-DDD		0.015
o,p'-DDD	<	0.010
p,p'-DDE		0.090
o,p'-DDE		0.017
p,p'-DDT	<	0.010
o,p'-DDT	<	0.010
DIELDRIN		0.016
ENDOSULFAN I	<	0.020
ENDOSULFAN II	<	0.020
ENDOSULFAN SULFATE	<	0.020
ENDRIN	<	0.010
ENDRIN ALDEHYDE	<	0.010
ENDRIN KETONE	<	0.010
HEPTACHLOR	B	0.074
HEPTACHLOR EPOXIDE	<	0.008
HEXACHLOROBENZENE	<	0.010
METHOXYCHLOR	<	0.020
PENTACHLOROANISOLE	<	0.008
TOXAPHENE		NA

TOTAL PCB 0.240 MG/KG

AROCLOR 1242	NA
AROCLOR 1248	NA
AROCLOR 1254	NA
AROCLOR 1260	NA

BASE/NEUTRAL EXTRACTABLE COMPOUNDS		(MG/KG)
ACENAPHTHYLENE	<	0.660
ACENAPHTHENE	<	0.660
4-CHLOROANILINE	<	0.660
2-NITROANILINE	<	3.200
3-NITROANILINE	<	3.200
4-NITROANILINE	<	3.200
ANTHRACENE	<	0.660
BENZO(a)ANTHRACENE	<	0.660
DIBENZO(a,h)ANTHRACENE	<	0.660
3,3'-DICHLOROBENZIDINE	<	1.300
1,2-DICHLOROBENZENE	<	0.660
1,3-DICHLOROBENZENE	<	0.660
1,4-DICHLOROBENZENE	<	0.660
1,2,4-TRICHLORBENZENE	<	0.660
HEXACHLOROBENZENE	<	0.660
NITROBENZENE	<	0.660
BENZYL ALCOHOL	<	0.660
CHRYSENE	<	0.660
n-NITROSODIPHENYLAMINE	<	0.660
n-NITROSO-di-n-PROPYLAMINE	<	0.660
HEXACHLOROETHANE	<	0.660
BIS(2-CHLOROETHYL)ETHER	<	0.660
BIS(2-CHLOROISOPROPYL)ETHER	<	0.660
4-BROMOPHENYL-PHENYLETHER	<	0.660
4-CHLOROPHENYL-PHENYLETHER	<	0.660
FLUORANTHENE	<	0.660
FLUORENE	<	0.660
BENZO(beta)FLUORANTHENE	<	0.660
BENZO(kappa)FLUORANTHENE	<	0.660
DIBENZOFURAN	<	0.660
BIS(2-CHLOROETHOXY)METHANE	<	0.660
ISOPHORONE	<	0.660
NAPHTHALENE	<	0.660
2-CHLORONAPHTHALENE	<	0.660
2-METHYLNAPHTHALENE	<	0.660
HEXACHLOROCYCLOPENTADIENE		NA
BENZO(ghi)PERYLENE	<	0.660
PHENANTHRENE	<	0.660
di-n-BUTYLPHTHALATE	J	0.140
DIETHYLPHTHALATE	<	0.660
DIMETHYLPHTHALATE	<	0.660
di-n-OCTYLPHTHALATE	<	0.660
BIS(2-ETHYLHEXYL)PHTHALATE	<	0.660
BUTYLBENZYLPHTHALATE	<	0.660
PYRENE	<	0.660
BENZO(alpha)PYRENE	<	0.660
INDENO(1,2,3-c,d)PYRENE	<	0.660
2,4-DINITROTOLUENE	<	0.660
2,6-DINITROTOLUENE	<	0.660
HEXACHLOROBUTADIENE	<	0.660

ACID EXTRACTABLE COMPOUNDS		(MG/KG)
BENZOIC ACID		NA
PHENOL	<	0.660
2-CHLOROPHENOL	<	0.660
2,4-DICHLOROPHENOL	<	0.660
2,4,5-TRICHLOROPHENOL	<	3.200
2,4,6-TRICHLOROPHENOL	<	0.660
PENTACHLOROPHENOL	<	3.200
2-METHYLPHENOL	<	0.660
4-METHYLPHENOL	<	0.660
2,4-DIMETHYLPHENOL	<	0.660
4-CHLORO-3-METHYLPHENOL	<	0.660
4,6-DINITRO-2-METHYLPHENOL		NA
2-NITROPHENOL	<	0.660
4-NITROPHENOL	<	3.200
2,4-DINITROPHENOL		NA

VOLATILE ORGANIC COMPOUNDS (MG/KG)

ACETONE	BB	0.720
BENZENE	J	0.003
CHLOROBENZENE	<	0.005
ETHYLBENZENE	<	0.005
2-BUTANONE		0.028
CARBON DISULFIDE	<	0.005
CHLOROETHANE	<	0.010
1,1-DICHLOROETHANE	<	0.005
1,2-DICHLOROETHANE	<	0.005
1,1,1-TRICHLOROETHANE	<	0.005
1,1,2-TRICHLOROETHANE	<	0.005
1,1,2,2-TETRACHLORETHANE	<	0.005
1,1-DICHLOROETHYLENE	<	0.005
1,2-DICHLOROETHYLENE	<	0.005
TRICHLOROETHYLENE (TOTAL)	<	0.005
TETRACHLOROETHYLENE	<	0.005
2-HEXANONE	<	0.010
BROMOMETHANE	<	0.050
TRIBROMOMETHANE (BROMOFORM)	<	0.025
BROMODICHLOROMETHANE	<	0.025
DIBROMOCHLOROMETHANE	<	0.025
CHLOROMETHANE	<	0.010
DICHLOROMETHANE (METHYLENE CHLORIDE)	B	0.059
TRICHLOROMETHANE (CHLOROFORM)	B	0.009
TETRACHLOROMETHANE (CARBON TETRACHLORIDE)	<	0.025
4-METHYL-2-PENTANONE	<	0.010
1,2-DICHLOROPROPANE	<	0.005
c-1,3-DICHLOROPROPYLENE	<	0.025
t-1,3-DICHLOROPROPYLENE	<	0.025
STYRENE	<	0.005
TOLUENE	BJ	0.003
VINYL ACETATE		NA
VINYL CHLORIDE	<	0.010
TOTAL XYLENE	X	0.003

RESULTS REPORTED ON A WHOLE SAMPLE BASIS. D-DUPLICATE
H=HAZLETON ENVIRONMENTAL SERVICES, MADISON, WI I=ISDH FOOD AND DRUG LAB
NA-NOT ANALYZED ND=NONE DETECTED
OTHER FLAGS ARE EXPLAINED ON A SEPARATE SHEET

PRINT DATE: 17-Jun-1998

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM-BIOLOGICAL STUDIES
FISH TISSUE CONTAMINATION RESULTS
IDEM SAMPLE NUMBER:

LAB NUMBER:70706700 SITE:CEDAR LAKE COUNTY:LAKE |SPECIES:3 CARP
COLLECTION DATE:09-Jul-1987 LOCATION: LAB:H |PREPARATION:SK-OFF FILLETS

MEAN LENGTH(CM):40.1 RANGE(CM):37.3-42.9 MEAN WEIGHT(GM):866 RANGE(GM):681-1050 %LIPID:2.00

METALS		(MG/KG)
ALUMINUM	<	20.000
ANTIMONY	<	2.000
ARSENIC	<	0.500
BARIUM	<	5.000
BERYLLIUM	<	0.500
CADMIUM	<	0.500
CALCIUM		310.00
CHROMIUM	<	1.000
COBALT	<	5.000
COPPER	<	2.500
IRON		26.100
LEAD	<	0.500
MAGNESIUM		280.000
MANGANESE	<	1.500
MERCURY		0.039
NICKEL	<	4.000
POTASSIUM		3360.000
SELENIUM	<	1.000
SILVER	<	0.500
SODIUM	<	500.000
THALLIUM	<	2.000
VANADIUM	<	5.000
ZINC		13.100

PESTICIDES		(MG/KG)
ALDRIN	<	0.016
alpha-BHC	<	0.008
beta-BHC	<	0.008
delta-BHC	<	0.008
gamma-BHC	<	0.008
alpha-CHLORDANE	<	0.008
gamma-CHLORDANE	<	0.008
cis-NONACHLOR	<	0.008
trans-NONACHLOR	<	0.008
OXYCHLORDANE	<	0.008
p,p'-DDD	<	0.010
o,p'-DDD	<	0.010
p,p'-DDE	<	0.010
o,p'-DDE	<	0.010
p,p'-DDT	<	0.010
o,p'-DDT	<	0.010
DIELDRIN	<	0.010
ENDOSULFAN I	<	0.020
ENDOSULFAN II	<	0.020
ENDOSULFAN SULFATE	<	0.020
ENDRIN	<	0.010
ENDRIN ALDEHYDE	<	0.010
ENDRIN KETONE	<	0.010
HEPTACHLOR	B	0.014
HEPTACHLOR EPOXIDE	<	0.008
HEXACHLOROBENZENE	<	0.010
METHOXYCHLOR	<	0.020
PENTACHLOROANISOLE	<	0.008
TOXAPHENE		NA

TOTAL PCB < 0.050 MG/KG

AROCLOR 1242	NA
AROCLOR 1248	NA
AROCLOR 1254	NA
AROCLOR 1260	NA

BASE/NEUTRAL EXTRACTABLE COMPOUNDS		(MG/KG)
ACENAPHTHYLENE	<	0.660
ACENAPHTHENE	<	0.660
4-CHLOROANILINE	<	0.660
2-NITROANILINE	<	3.200
3-NITROANILINE	<	3.200
4-NITROANILINE	<	3.200
ANTHRACENE	<	0.660
BENZO(a)ANTHRACENE	<	0.660
DIBENZO(a,h)ANTHRACENE	<	0.660
3,3'-DICHLOROBENZIDINE	<	1.300
1,2-DICHLOROBENZENE	<	0.660
1,3-DICHLOROBENZENE	<	0.660
1,4-DICHLOROBENZENE	<	0.660
1,2,4-TRICHLORBENZENE	<	0.660
HEXACHLOROBENZENE	<	0.660
NITROBENZENE	<	0.660
BENZYL ALCOHOL	<	0.660
CHRYSENE	<	0.660
n-NITROSODIPHENYLAMINE	BJ	0.280
n-NITROSO-di-n-PROPYLAMINE	<	0.660
HEXACHLOROETHANE	<	0.660
BIS(2-CHLOROETHYL)ETHER	<	0.660
BIS(2-CHLOROISOPROPYL)ETHER	<	0.660
4-BROMOPHENYL-PHENYLETHER	<	0.660
4-CHLOROPHENYL-PHENYLETHER	<	0.660
FLUORANTHENE	<	0.660
FLUORENE	<	0.660
BENZO(beta)FLUORANTHENE	<	0.660
BENZO(kappa)FLUORANTHENE	<	0.660
DIBENZOFURAN	<	0.660
BIS(2-CHLOROETHOXY)METHANE	<	0.660
ISOPHORONE	<	0.660
NAPHTHALENE	<	0.660
2-CHLORONAPHTHALENE	<	0.660
2-METHYLNAPHTHALENE	<	0.660
HEXACHLOROCYCLOPENTADIENE		NA
BENZO(ghi)PERYLENE	<	0.660
PHENANTHRENE	<	0.660
di-n-BUTYLPHTHALATE		5.300
DIETHYLPHTHALATE	<	0.660
DIMETHYLPHTHALATE	<	0.660
di-n-OCTYLPHTHALATE	<	0.660
BIS(2-ETHYLHEXYL)PHTHALATE	<	0.660
BUTYLBENZYLPHTHALATE	<	0.660
PYRENE	<	0.660
BENZO(alpha)PYRENE	<	0.660
INDENO(1,2,3-c,d)PYRENE	<	0.660
2,4-DINITROTOLUENE	<	0.660
2,6-DINITROTOLUENE	<	0.660
HEXACHLOROBUTADIENE	<	0.660

ACID EXTRACTABLE COMPOUNDS		(MG/KG)
BENZOIC ACID		NA
PHENOL	<	0.660
2-CHLOROPHENOL	<	0.660
2,4-DICHLOROPHENOL	<	0.660
2,4,5-TRICHLOROPHENOL	<	3.200
2,4,6-TRICHLOROPHENOL	<	0.660
PENTACHLOROPHENOL	<	3.200
2-METHYLPHENOL	<	0.660
4-METHYLPHENOL	<	0.660
2,4-DIMETHYLPHENOL	<	0.660
4-CHLORO-3-METHYLPHENOL	<	0.660
4,6-DINITRO-2-METHYLPHENOL		NA
2-NITROPHENOL	<	0.660
4-NITROPHENOL	<	3.200
2,4-DINITROPHENOL		NA

VOLATILE ORGANIC COMPOUNDS (MG/KG)

ACETONE	BE	0.700
BENZENE		0.005
CHLOROBENZENE	<	0.005
ETHYLBENZENE	<	0.005
2-BUTANONE		0.046
CARBON DISULFIDE	J	0.002
CHLOROETHANE	<	0.010
1,1-DICHLOROETHANE	<	0.005
1,2-DICHLOROETHANE	<	0.005
1,1,1-TRICHLOROETHANE	<	0.005
1,1,2-TRICHLOROETHANE	<	0.005
1,1,2,2-TETRACHLORETHANE	<	0.005
1,1-DICHLOROETHYLENE	<	0.005
1,2-DICHLOROETHYLENE	<	0.005
TRICHLOROETHYLENE (TOTAL)	<	0.005
TETRACHLOROETHYLENE	<	0.005
2-HEXANONE	<	0.010
BROMOMETHANE	<	0.050
TRIBROMOMETHANE (BROMOFORM)	<	0.025
BROMODICHLOROMETHANE	<	0.025
DIBROMOCHLOROMETHANE	<	0.025
CHLOROMETHANE	<	0.010
DICHLOROMETHANE (METHYLENE CHLORIDE)	B	0.050
TRICHLOROMETHANE (CHLOROFORM)	B	0.018
TETRACHLOROMETHANE (CARBON TETRACHLORIDE)	<	0.025
4-METHYL-2-PENTANONE	<	0.010
1,2-DICHLOROPROPANE	<	0.005
c-1,3-DICHLOROPROPYLENE	<	0.025
t-1,3-DICHLOROPROPYLENE	<	0.025
STYRENE	<	0.005
TOLUENE	BJ	0.004
VINYL ACETATE		NA
VINYL CHLORIDE	<	0.010
TOTAL XYLENE	JX	0.004

RESULTS REPORTED ON A WHOLE SAMPLE BASIS. D-DUPLICATE
H-HAZLETON ENVIRONMENTAL SERVICES, MADISON, WI I=ISDH FOOD AND DRUG LAB
NA-NOT ANALYZED ND-NONE DETECTED
OTHER FLAGS ARE EXPLAINED ON A SEPARATE SHEET

PRINT DATE: 17-Jun-1998

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM-BIOLOGICAL STUDIES
FISH TISSUE CONTAMINATION RESULTS
IDEM SAMPLE NUMBER:

LAB NUMBER: 70706701 SITE: CEDAR LAKE COUNTY: LAKE | SPECIES: 3 CARP
COLLECTION DATE: 09-Jul-1987 LOCATION: LAB: H | PREPARATION: SK-ON FILLETS

MEAN LENGTH (CM): 42.2 RANGE (CM): 39.0-43.6 MEAN WEIGHT (GM): 937 RANGE (GM): 766-1022 %LIPID: 3.60

METALS		(MG/KG)
ALUMINUM		36.100
ANTIMONY	<	2.000
ARSENIC	<	0.500
BARIUM	<	5.000
BERYLLIUM	<	0.500
CADMIUM	<	0.500
CALCIUM		460.00
CHROMIUM		1.500
COBALT	<	5.000
COPPER	<	2.500
IRON		22.800
LEAD	<	0.500
MAGNESIUM		270.000
MANGANESE	<	1.500
MERCURY		0.049
NICKEL	<	4.000
POTASSIUM		3180.000
SELENIUM	<	1.000
SILVER	<	0.500
SODIUM	<	500.000
THALLIUM	<	2.000
VANADIUM	<	5.000
ZINC		28.500

PESTICIDES		(MG/KG)
ALDRIN	<	0.168
alpha-BHC	<	0.008
beta-BHC	<	0.008
delta-BHC	<	0.008
gamma-BHC		0.009
alpha-CHLORDANE		0.055
gamma-CHLORDANE		0.200
cis-NONACHLOR		0.012
trans-NONACHLOR		0.020
OXYCHLORDANE	<	0.008
p,p'-DDD	<	0.010
o,p'-DDD	<	0.010
p,p'-DDE	<	0.010
o,p'-DDE		0.057
p,p'-DDT		0.024
o,p'-DDT	<	0.010
DIELDRIN		0.020
ENDOSULFAN I	<	0.020
ENDOSULFAN II	<	0.020
ENDOSULFAN SULFATE	<	0.020
ENDRIN	<	0.010
ENDRIN ALDEHYDE	<	0.010
ENDRIN KETONE	<	0.010
HEPTACHLOR	B	1.611
HEPTACHLOR EPOXIDE	<	0.008
HEXACHLOROBENZENE		0.009
METHOXYCHLOR	<	0.020
PENTACHLOROANISOLE	<	0.008
TOXAPHENE		NA

TOTAL PCB 0.170 MG/KG

AROCLOR 1242	NA
AROCLOR 1248	NA
AROCLOR 1254	NA
AROCLOR 1260	NA

BASE/NEUTRAL EXTRACTABLE COMPOUNDS		(MG/KG)
ACENAPHTHYLENE	<	0.660
ACENAPHTHENE	<	0.660
4-CHLOROANILINE	<	0.660
2-NITROANILINE	<	3.200
3-NITROANILINE	<	3.200
4-NITROANILINE	<	3.200
ANTHRACENE	<	0.660
BENZO(a)ANTHRACENE	<	0.660
DIBENZO(a,h)ANTHRACENE	<	0.660
3,3'-DICHLOROBENZIDINE	<	1.300
1,2-DICHLOROBENZENE	<	0.660
1,3-DICHLOROBENZENE	<	0.660
1,4-DICHLOROBENZENE	<	0.660
1,2,4-TRICHLORBENZENE	<	0.660
HEXACHLOROBENZENE	<	0.660
NITROBENZENE	<	0.660
BENZYL ALCOHOL	<	0.660
CHRYSENE	<	0.660
n-NITROSODIPHENYLAMINE	BJ	0.250
n-NITROSO-di-n-PROPYLAMINE	<	0.660
HEXACHLOROETHANE	<	0.660
BIS(2-CHLOROETHYL)ETHER	<	0.660
BIS(2-CHLOROISOPROPYL)ETHER	<	0.660
4-BROMOPHENYL-PHENYLETHER	<	0.660
4-CHLOROPHENYL-PHENYLETHER	<	0.660
FLUORANTHENE	<	0.660
FLUORENE	<	0.660
BENZO(beta)FLUORANTHENE	<	0.660
BENZO(kappa)FLUORANTHENE	<	0.660
DIBENZOFURAN	<	0.660
BIS(2-CHLOROETHOXY)METHANE	<	0.660
ISOPHORONE	<	0.660
NAPHTHALENE	<	0.660
2-CHLORONAPHTHALENE	<	0.660
2-METHYLNAPHTHALENE	<	0.660
HEXACHLOROCYCLOPENTADIENE		NA
BENZO(ghi)PERYLENE	<	0.660
PHENANTHRENE	<	0.660
di-n-BUTYLPHTHALATE	<	0.660
DIETHYLPHTHALATE	<	0.660
DIMETHYLPHTHALATE	<	0.660
di-n-OCTYLPHTHALATE	<	0.660
BIS(2-ETHYLHEXYL)PHTHALATE	<	0.660
BUTYLBENZYLPHTHALATE	<	0.660
PYRENE	<	0.660
BENZO(alpha)PYRENE	<	0.660
INDENO(1,2,3-c,d)PYRENE	<	0.660
2,4-DINITROTOLUENE	<	0.660
2,6-DINITROTOLUENE	<	0.660
HEXACHLOROBUTADIENE	<	0.660

ACID EXTRACTABLE COMPOUNDS		(MG/KG)
BENZOIC ACID		NA
PHENOL	<	0.660
2-CHLOROPHENOL	<	0.660
2,4-DICHLOROPHENOL	<	0.660
2,4,5-TRICHLOROPHENOL	<	3.200
2,4,6-TRICHLOROPHENOL	<	0.660
PENTACHLOROPHENOL	<	3.200
2-METHYLPHENOL	<	0.660
4-METHYLPHENOL	<	0.660
2,4-DIMETHYLPHENOL	<	0.660
4-CHLORO-3-METHYLPHENOL	<	0.660
4,6-DINITRO-2-METHYLPHENOL		NA
2-NITROPHENOL	<	0.660
4-NITROPHENOL	<	3.200
2,4-DINITROPHENOL		NA

VOLATILE ORGANIC COMPOUNDS (MG/KG)

ACETONE	BE	1.100
BENZENE	J	0.003
CHLOROBENZENE	<	0.005
ETHYLBENZENE	<	0.005
2-BUTANONE		0.033
CARBON DISULFIDE		0.013
CHLOROETHANE	<	0.010
1,1-DICHLOROETHANE	<	0.005
1,2-DICHLOROETHANE	<	0.005
1,1,1-TRICHLOROETHANE	<	0.005
1,1,2-TRICHLOROETHANE	<	0.005
1,1,2,2-TETRACHLORETHANE	<	0.005
1,1-DICHLOROETHYLENE	<	0.005
1,2-DICHLOROETHYLENE	<	0.005
TRICHLOROETHYLENE (TOTAL)	<	0.005
TETRACHLOROETHYLENE	<	0.005
2-HEXANONE	<	0.010
BROMOMETHANE	<	0.050
TRIBROMOMETHANE (BROMOFORM)	<	0.025
BROMODICHLOROMETHANE	<	0.025
DIBROMOCHLOROMETHANE	<	0.025
CHLOROMETHANE	<	0.010
DICHLOROMETHANE (METHYLENE CHLORIDE)	B	0.140
TRICHLOROMETHANE (CHLOROFORM)	B	0.019
TETRACHLOROMETHANE (CARBON TETRACHLORIDE)	<	0.025
4-METHYL-2-PENTANONE	<	0.010
1,2-DICHLOROPROPANE	<	0.005
c-1,3-DICHLOROPROPYLENE	<	0.025
t-1,3-DICHLOROPROPYLENE	<	0.025
STYRENE	<	0.005
TOLUENE	BJ	0.003
VINYL ACETATE		NA
VINYL CHLORIDE	<	0.010
TOTAL XYLENE	X	0.006

RESULTS REPORTED ON A WHOLE SAMPLE BASIS. D-DUPLICATE PRINT DATE: 17-Jun-1998
H-HAZLETON ENVIRONMENTAL SERVICES, MADISON, WI I=ISDH FOOD AND DRUG LAB
NA-NOT ANALYZED ND-NONE DETECTED
OTHER FLAGS ARE EXPLAINED ON A SEPARATE SHEET

APPENDIX 4

Input Data for Case I (In situ volume of material to be dredged: 670,000 cu yd)

- Sediment Data
  - In situ volume of material to be dredged: 670,000 cu yd
  - Percent, by weight, of material that passes a No. 200 sieve, smaller than 0.074 mm: 48.3 %
  - Average specific gravity of the material: 2.714
  - Average in situ solids concentration: 298.368 g/L
  - Average in situ void ratio: 8.096
  - Average in situ water content: 298.311 %
  - Average in situ percent solids by weight: 25.106 %

- Settled Sand Data
  - Average specific gravity of the sands and gravels: 2.68
  - Average concentration of settled sands: 1603 g/L
  - Average dry density of the settled sands: 100 lb/cu ft
  - Average void ratio of settled sands: 0.672
  - Average water content of settled sands: 25.07 %
  - Average concentration of settled sands in Percent solids by weight: 79.955 %

- Production Rate and Operation Time Data
  - Influent discharge flow rate: 18.51 cfs
  - Influent pipe diameter: 14 inches
  - Average pipeline velocity: 17.31 fps
  - Influent suspended solids concentration: 41.66 g/L
  - Influent percent solids by weight: 4.06%
  - Solids output in terms of volumetric rate of In situ material disposal by the dredge: 400.69 cu yd/hr
  - Number of hours/day the dredge is operating: 12 hrs/day
  - Estimated time to complete the dredging: 195.08 days
  - Average number of operating days per week: 5 days/week

- Disposal Area Configuration Data
  - Average depth remaining below the crest of The dike or average dike height 6 ft
  - Minimum freeboard: 2 ft
  - Minimum ponded water depth required: 2 ft
  - Depth of withdrawal or ponding at the weir: 2 ft
  - Average storage area, accounting for dike slope: 80 acres

- Percent of the above area ponded at the end of The dredging operation: 85 %
- Hydraulic efficiency of the disposal area: 70.40 %
- Max. allowable effluent solids concentration: 50 mg/L

Output for Case I (In situ volume of material to be dredged: 670,000 cu yd)

- Initial storage results using compression settling test data:
  - Minimum interior area 61.69 acres
  - Required storage volume 141.88 acre-ft

  - Minimum dept or dike height 5.47 feet
  - Required storage volume 141.88 acre-ft
  - Minimum dept of storage 1.77 feet

  - Maximum influent flow rate 114.5 cfs
  - Maximum production rate 2131.98 cu yd/hr
  - Minimum disposal period 36.66 days

  - Maximum in situ volume 913,414 cu yd

- Clarification results using zone settling test data:
  - Minimum interior area 5.22 acres
  - Minimum ponded area 4.43 acres

  - Maximum influent flow rate 284.9 cfs

- Effluent quality results using flocculent settling test data:
  - Minimum interior area 46.57 acres
  - Minimum ponded area 39.58 acres
  - Minimum ponded volume 79.17 acre-ft
  - Minimum mean residence time 102.01 hours

  - Minimum depth of ponding 1.29 feet
  - Minimum ponded volume 88.33 acre-ft
  - Minimum mean residence time 113.82 hours

  - Maximum influent flow rate 31.9 cfs
  - Minimum mean residence time 102.01 hours

- Effluent solids concentration 9.43 mg/L

Input Data for Case II (In situ volume of material to be dredged: 130,000 cu yd)

- Sediment Data
  - In situ volume of material to be dredged: 130,000 cu yd
  - Percent, by weight, of material that passes a No. 200 sieve, smaller than 0.074 mm: 48.3 %
  - Average specific gravity of the material: 2.714
  - Average in situ solids concentration: 500.368 g/L
  - Average in situ void ratio: 4.424
  - Average in situ water content: 163.007 %
  - Average in situ percent solids by weight: 38.022 %

- Settled Sand Data
  - Average specific gravity of the sands and gravels: 2.68
  - Average concentration of settled sands: 1603 g/L
  - Average dry density of the settled sands: 100 lb/cu ft
  - Average void ratio of settled sands: 0.672
  - Average water content of settled sands: 25.07 %
  - Average concentration of settled sands in Percent solids by weight: 79.955 %

- Production Rate and Operation Time Data
  - Influent discharge flow rate: 12.02 cfs
  - Influent pipe diameter: 12 inches
  - Average pipeline velocity: 15 .31 fps
  - Influent suspended solids concentration: 65.29 g/L
  - Influent percent solids by weight: 6.27 %
  - Solids output in terms of volumetric rate of In situ material disposal by the dredge: 350.69 cu yd/hr
  - Number of hours/day the dredge is operating: 12 hrs/day
  - Estimated time to complete the dredging: 43.25 days
  - Average number of operating days per week: 5.0 days/week

- Disposal Area Configuration Data
  - Average depth remaining below the crest of The dike or average dike height 6 ft
  - Minimum freeboard: 2 ft
  - Minimum ponded water depth required: 2 ft
  - Depth of withdrawal or ponding at the weir: 2 ft
  - Average storage area, accounting for dike slope: 35.3 acres

- Percent of the above area ponded at the end of The dredging operation: 85 %
- Hydraulic efficiency of the disposal area: 75.4 %
- Max. allowable effluent solids concentration: 50 mg/L

Output for Case II (In situ volume of material to be dredged: 130,000 cu yd)

- Initial storage results using compression settling test data:
    - Minimum interior area 25.43 acres
    - Required storage volume 58.49 acre-ft

    - Minimum dept or dike height 5.36 feet
    - Required storage volume 58.49 acre-ft
    - Minimum dept of storage 1.66 feet

    - Maximum influent flow rate 138.78 cfs
    - Maximum production rate 2414.45 cu yd/hr
    - Minimum disposal period 6.28 days

    - Maximum in situ volume 192,213 cu yd
- Clarification results using zone settling test data:
    - Minimum interior area 3.16 acres
    - Minimum ponded area 2.69 acres

    - Maximum influent flow rate 134.14 cfs
- Effluent quality results using flocculent settling test data:
    - Minimum interior area 28.23 acres
    - Minimum ponded area 24.00 acres
    - Minimum ponded volume 48.00 acre-ft
    - Minimum mean residence time 102.01hours

    - Minimum depth of ponding 1.78 feet
    - Minimum ponded volume 53.55 acre-ft
    - Minimum mean residence time 113.82 hours

    - Maximum influent flow rate 15.03 cfs
    - Minimum mean residence time 102.01 hours

- Effluent solids concentration 27.1 mg/L

Outlet Works Design

a. Case I (In situ volume of material to be dredged: 670,000 cu yd)

- Flocculent Settling
    - Withdrawal depth: 2.00 ft
    - Design flow rate: 18.51 cfs
    - Weir length: 43.0 ft

- Zone or Compression Settling
    - Withdrawal depth: 2.00 ft
    - Design flow rate: 18.51 cfs
    - Weir length: 21.1 ft

a. Case II (In situ volume of material to be dredged: 130,000 cu yd)

- Flocculent Settling
    - Withdrawal depth: 2.00 ft
    - Design flow rate: 12.02 cfs
    - Weir length: 28.0 ft

- Zone or Compression Settling
    - Withdrawal depth: 2.00 ft
    - Design flow rate: 18.51 cfs
    - Weir length: 13.7 ft

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